

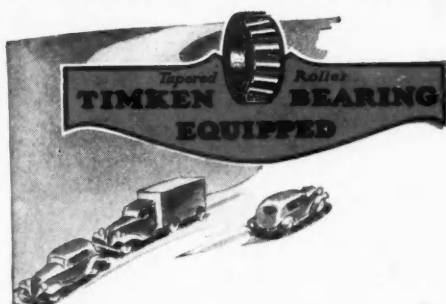
AUTOMOTIVE INDUSTRIES

LAND AIR WATER

Volume 68
Number 12

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PHILADELPHIA, MARCH 25, 1933

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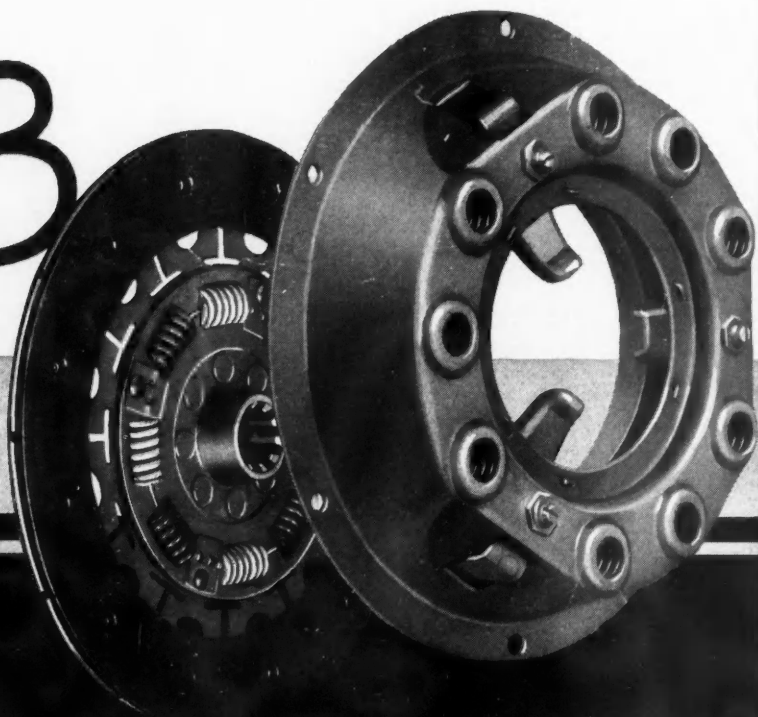
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AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Volume 68

Reg. U. S. Pat. Off.

Number 12

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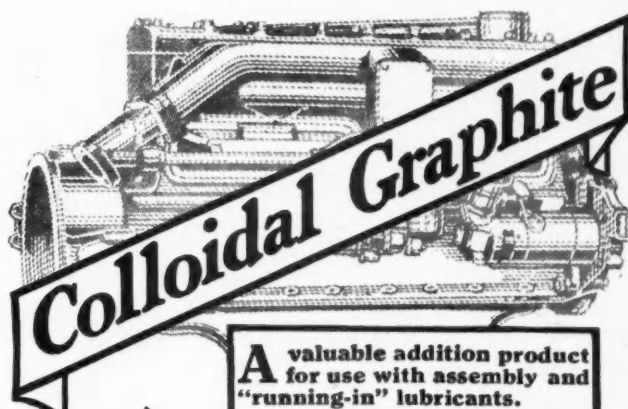
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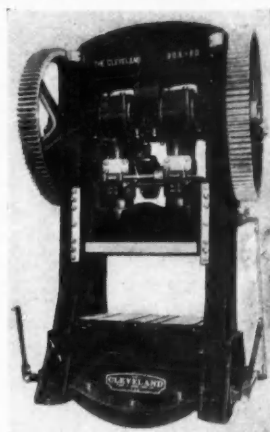
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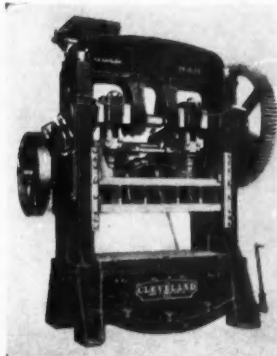


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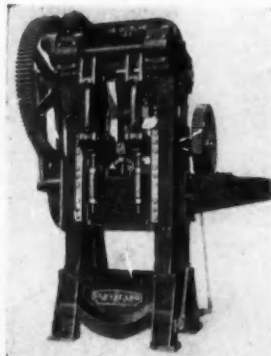
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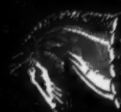
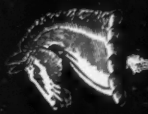


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March 25, 1933

Automotive Industries



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1 Reverse Shift Yoke	1 Split Nut and Reverse Lever	1 Split Nut Guide
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1 Threading Dial Gear	1 3-Step Cone V Pulley Spindle	2 Hand Wheels
1 Comp. Gear Bushing	1 3-Step Cone Pulley Center Shaft	1 Split Nut Scroll
2 Carriage Traverse Gears	1 2-Step Idler V Pulley Spindle	4 V Belt Pulleys
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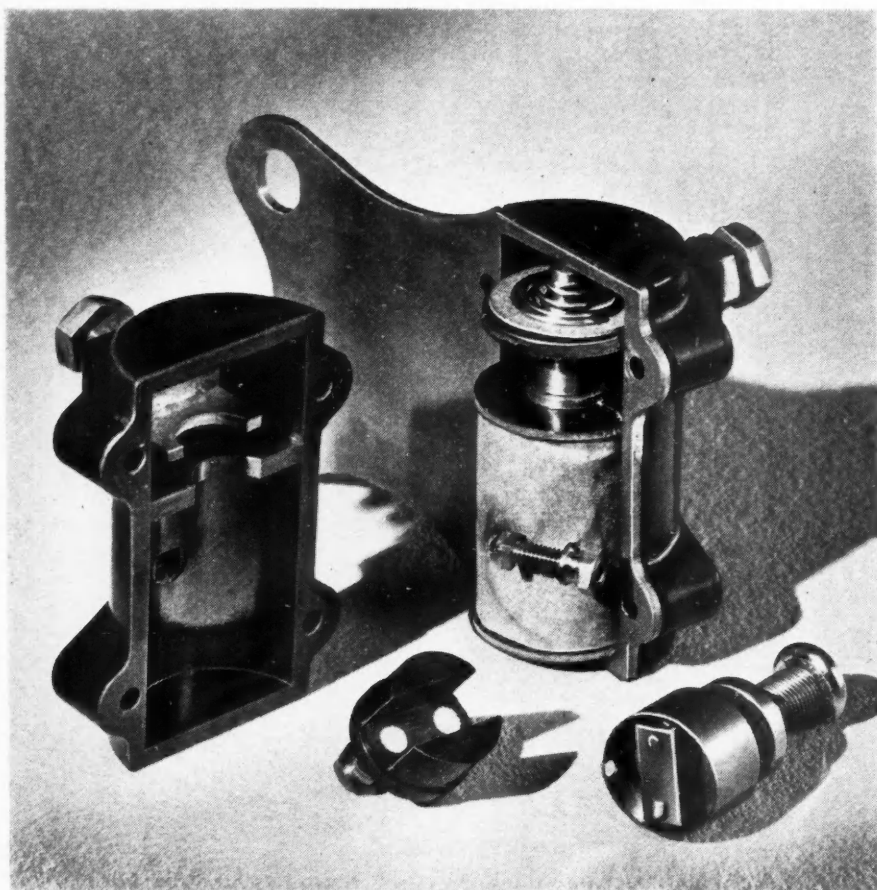
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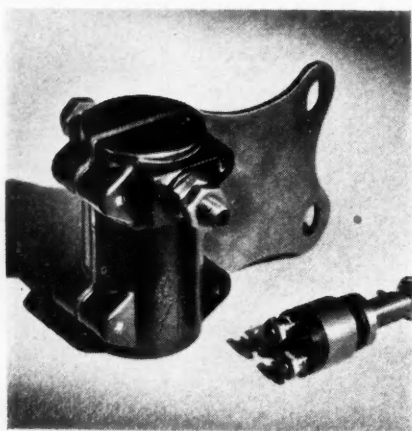
BUTIN-START makes good use of Bakelite Materials

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The BUTIN-START, with housing and parts of Bakelite Materials. Made by Gil-Stick Corp., New York, N.Y.



the other for the contact. The ends of the solenoid spool are Bakelite Laminated punchings. The terminal block of the push-button assembly also is of Bakelite Molded.

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THE MATERIAL OF A THOUSAND USES

March 25, 1933

Automotive Industries

FEAR —

by
Julian Chase

Directing Editor,
The Chilton Co.

Father of the UGLY TWINS, PRICE CUTTING and CHISELING

IN A newspaper, recently, we read the following paragraphs under the heading "Leadership":

"Informed opinion anticipates a gradual but complete change of financial and industrial leadership as one result of the new deal. You hear the prediction freely made that no one who was in authority in 1928 will still be in power five years from now. New conditions demand a new attitude.

"The theory is gaining ground that cycles of leadership have something to do with cycles of depression. A group of leaders get set in their mental ways and cannot adapt themselves to renewing growth. They discover a comfortable formula and stick to it. Then you get a blowoff—and replacements. These take time."

What is the real New Deal? To some it is merely a political catch-phrase on which a man rode into the Presidency. To others it is a social and economic upheaval of the character and proportions of a revolution. To still others it appears just as portentously and consequentially gigantic, but assumes the aspect of a natural but irregular step in the evolution of human relations.

Fundamental changes, undoubtedly, are taking place. They always have been taking place. They will continue to do so. The sub-surface movement is nearly constant in spite of the fact that its surface manifestations give the effect of interrupted progress like that of an automobile with a clutch which alternately slips and grips, while the engine under the hood keeps steadily running. Each jump forward is a new deal.

Looking at things from a detached, impersonal viewpoint, we all see and comprehend more or less clearly

what is going on. We note the new conceptions, as we are prone to call them, of all major social and economic relationships, the new ideas regarding the responsibilities of capital and the rights of labor, the higher values given to the live-and-let-live principle in our daily dealings, the spreading recognition of the importance of health and strength in all elements of our social and economic structure, the growing belief that the stability of the structure depends upon the welfare of all its units. We see things as distant abstractions, but do we see them so well as concrete realities at close range? Do we correctly measure their influence and grasp their full significance or portentousness to us individually who are factors in the creation of policies and practices within the industry of which we are more or less important parts? "New conditions demand a new attitude," says the newspaper item quoted above. Has our attitude changed to conform to the New Deal? It is well for us if it has. And us means everyone, industrially speaking.

The automotive industry has rolled along through its years with a relatively small amount of rough going. Its road has been smoothed for it to an important extent, because it has, for the most part, followed a course prepared by a great economic development. It contributed materially to that development, of course, but the development contributed more to it. Man, with his legs alone, can jump over a bar not much more than six feet from the ground. With a pole, which he himself has made, he can clear a bar four times as high, but he is still a man and not a super-man.

As the automotive industry has grown, certain more or less characteristic methods, practices and attitudes

Competition presents the least of the problems to be solved today. If we are afraid of it, how shall we find the courage required to put into effect the fundamental changes which the times require?

have become pretty definitely fixed in its general policies. Considering its history as a whole since the days of the curved-dash runabout (which was bought with a 25 per cent deposit placed with the order and the balance in cash or certified check paid on delivery), the automotive industry has been a huge success. The methods and practices of successful enterprises are generally, even though often erroneously, accepted as correct. But because fundamental conditions change and are continually changing, the success of the past is no guarantee of the continued correctness of the methods, practices and attitudes which have prevailed. It is easy to ask, who doesn't know that? It is more pertinent to ask and more important to find out, who does.

When we know that changes must be made, we find that the greatest deterrent to putting them into effect is an ingrained fear which is a part of all of us. Fear is a killer. We have lately seen what fear can do. We have seen an overpowering monster grow out of the weakness of our hearts and minds. We have seen the forebodings of timid souls, in high places and in low, transformed into that mighty vulture which, feeding on bank accounts, on credits and on reputations, vomits bankruptcy and misery.

That kind of fear, the kind of fear which can petrify our economic system is, happily, only an intermittent obsession. It has, however, an inferior counterpart which is always with us. No industry is altogether free of it. Our industry most surely has it. Sometimes it seems that there is no single individual in our industry, from one end to the other, who is free of it. If we listen to some of our critics, we may believe that this fear, or more particularly its indirect manifestations, form some of our chief characteristics. They tell us that it unfavorably influences many of our relationships. They say that it hurts us in many ways.

The making of changes of any kind calls for courage, for the kind of courage which the automotive industry has shown in certain major respects during the past two years and, for that matter, in all years since its beginning. It will take courage to make changes in policies and practices to meet the new conditions, just as it took courage to bring out new products to meet other new conditions, to offer new and greater values in the face of tremendous obstacles in

an effort to keep men at work and to hold institutions intact. No industry has done more, no other industry has, perhaps, done as much to keep things going. There was no folding up, no wilting, no lying down on the job. And yet, even in this demonstration of confidence and determination, there were, as there always have been, the baneful evidences of an insidious fear—the fear of competition. We see this fear most conspicuously manifested in price-cutting and its equally unhealthy and ugly brother—chiseling.

In a letter which has just come in, a leading executive of an automobile manufacturing company says: "In the wild scramble to force lower retail prices, there is no one apparently with nerve enough to take a step in the other direction. All seem to be concerned over what one manufacturer might do if prices were increased in order to pay higher wages to labor and in order to pay the vendors a price enabling them, in turn, to make a living profit and pay reasonable wages to their labor. The industry will never be righted until manufacturers decide to use good horse-sense and make it possible for everyone to make money. There would be just as many automobiles sold on a 5 per cent mark-up over present lists all around, but the big fellows say that if they did that some one manufacturer would come out and tell the world that the increase was unjustified and prices would go down again instead of up."

What is it but fear that creates such a situation? Competition presents the least of the problems to be solved today. If we are afraid of it, how shall we find the courage required to put into effect the fundamental changes which the times require, the courage to assume the new responsibilities of employer to employed, to recognize and be guided by the new values which must be given to the live-and-let-live principle in our daily dealings? Where shall we find the courage to give the force and effectiveness of practical application to the growing conviction that the stability of our industrial structure depends upon the welfare of all its units—the welfare of parts, material and equipment suppliers, of distributors and dealers and of complete product manufacturers.

All this courage and more is called for by the New Deal. Will it be found in our old industrial leaders or shall we have to wait for new ones to arise who can "adapt themselves to renewing growth?"

JUST AMONG OURSELVES

The Things We Need

THE eminent gentlemen who comprise the recently formed "Committee for the Nation" must be approving along with most of the rest of us some of the recent economic and financial moves which the government has been making.

In an interim report issued several weeks ago, this committee—headed by Frank A. Vanderlip, and numbering among its National Advisory Committee Vincent Bendix, E. L. Cord and Wm. J. McAneeny—urged safeguarding the banking situation, safeguarding our present monetary gold stock, stimulation of a movement to balance governmental budgets, raising the commodity price level and stimulation of purchasing power of consumers.

All of these things haven't been accomplished yet, but a real start seems to have been made on the more important of them since the time the report was issued. Certainly the consummation of constructive governmental movements toward economic stability must be helped materially, both in guidance and action, by the efforts of this group of prominent industrialists.

The Committee for the Nation came into being some months ago when a group of leaders of business and agriculture became alarmed over the dangerous trends in our business situation and quietly organized. Existing economic conditions were analyzed and a special program of research by the National Industrial Conference

Board was instituted. Specialists in finance, industrialists, farm leaders, economists and others contributed their experience to the committee's work.

Grocers Show Way

JUST learned the other day that retail margins in the grocery field used to range around 30 to 35 per cent, but that nowadays profits are being made on 14 or 15 per cent—and that there are some very profitable grocery operations at 10 per cent. Independent grocers are getting along on these margins, in some instances, better than the chain stores, so we are told.

Something like the same thing has happened in the trend of automobile dealer discounts, despite the fact that the official discount still ranges from 20 to 30 per cent. Trading necessities reduce the practical working discount in every instance. The ability of the dealer as a trader, rather than his merchandising and managerial abilities alone, determines his actual discount.

How Far Recovery?

ASKED if we are going to snap out of our present economic predicament soon, C. F. Kettering the other day replied (according to General Motors Magazine):

"Sure, we're coming out. But here's the thing we've got to

watch out for; we've got to watch out for what we're coming out to. If we expect to come out to conditions of 1929, then we'll be disappointed. But there's no question about coming out."

Which reminds us of the story we heard last night of the mountain white in Kentucky who, when asked for a road direction by a stranger, replied that he could not read signposts. "I kin read figures," he said, "but not words. I kin tell how fur, but not where to."

... Well, we do some statistical work ourselves at times.

Keeping the Lines Moving

EVERY time labor problems come to the foreground, conversation gets around to the disadvantages of too much centralization of industry and the possible advantages of decentralization. No argument in the world lends itself less to accurate generalization. Whether greater or less decentralization is desirable in a particular instance depends on management competency, nature of product, distribution necessities and a host of other factors.

Concentration of manufacturing in a few large plants, as is common in many automotive enterprises, undoubtedly increases the dangers of interruption of the whole production program through labor troubles. Shutdown in manufacture of a single part, under these circumstances, means a block in the entire manufacturing scheme. That's one of the secondary reasons for the spreading of business among parts makers by vehicle manufacturers, although not much is heard about it. —N. G. S.

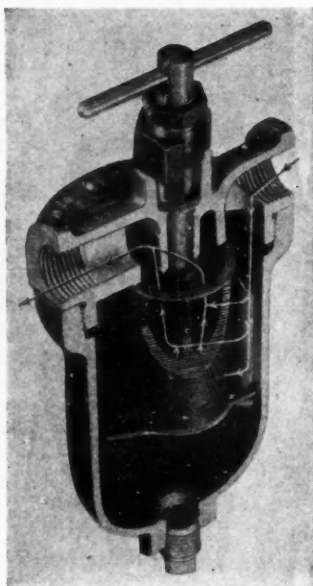


Fig. 1—Sectional view of a small sized Cuno Auto-Klean Filter. Arrows indicate the direction of flow of liquid

Quest for Spotlight

by Joseph Geschelin

Engineering Editor, Automotive Industries

BACK of car performance—speed, power, quietness—is the surface quality of important mating parts.

That's why there is an increasing demand for mirror finishes, by honing, diamond boring, burnishing, lapping, and the like.

Now we find that way down the line in the manufacturing process, the type of cutting fluid and particularly the method of handling it are assuming an all-important role. Other factors in the process being under control, there is a growing regard for the cleanliness of the cutting fluid as an essential to smooth, fine, finish. And in the opinion of many experts, cleanliness depends upon adequate straining or filtering.

As in the case of many other machine shop problems, the factory executive has been left to work out his own salvation. So we find but little research in this direction except in a few individual cases; no cooperative action similar to that in other technical activity; and naturally little unanimity of opinion.

Continuing our activity in the utilization of cutting fluids, we have based this article upon reports and opinions gathered from many authoritative sources. Thus we are enabled to view the relation of clean cutting fluid to fine finish in the light of recent research by the following groups:

1. Factory executives.
2. Machine tool builders.
3. Filter manufacturers.

A digest of the returns shows that the vote is unanimously "yes" on the question "Is clean cutting fluid essential to fine finish?" Many returns indicate that the requisite cleanliness is possible only through the use of an industrial filter of approved design. But when it comes to defining "fine" finish or just where the filter is a necessity, the issue is no longer clear cut.

For convenience, our study of the role of filters or filtering elements in the cleaning of cutting fluids has been resolved into the following elements:

1. Desirability of filters.
2. Type of machine or operation requiring a filter.
3. Requirements and types of industrial filters.
4. Methods of application.
5. Elements of economy.

PART 1. Where surface finish is the principal factor in the machining operation, the consensus is that the cleanness of the cutting fluid is a matter of major importance. This qualification rather narrows down the types of machines and the kinds of operations to be considered but their number is surprisingly high.

Thus, one machine tool builder says, "The use of a filter in keeping the coolant free from grit and foreign substances, when used in either grinding or the types that are used as a coolant directly applied to turning tools, such as screw machines, is of unquestioned value, particularly where a high degree of finish is required."

A prominent gear machine maker advises that "If the lubrication tank is of sufficient volume so that there

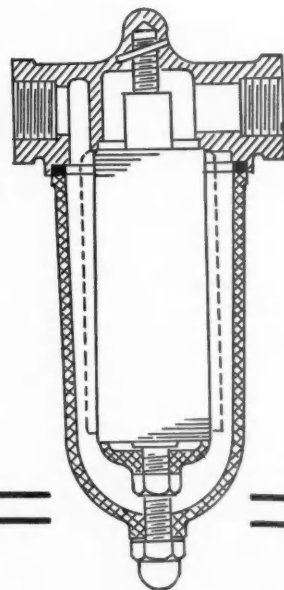


Fig. 2—A small Zenith filter with screen baffle protecting the metal discs

Finer Finishes Turns on Coolant Cleaning

Broad survey reveals present field opinions, practices and tendencies in keeping cutting fluids clean

is always a considerable reserve supply and the cutting compound has a chance to settle before being pumped again, some of the difficulties would seem to be removed. However it is claimed by some of our operators that it is the very fine dust carried in the oil which adheres to the cutter "really freezes on to it" and causes it to produce a rough surface on the work. This is more noticeable with some materials than with others."

Filtering appears to be advisable from two points of view, hygienic and physical. That is, not only does it clean the fluid and thus assure a fine finish free of scratches and imperfections but it eliminates the hazard of skin infection due to the lodging of minute particles of metal or abrasive in the skin.

It is claimed by a number of investigators that the usual still-pond or settling tank, although efficacious in general, does not remove the very fine metal particles or abrasive from the oil stream. In most cases this is of little concern, but where a mirror-finish or great smoothness is desired, it becomes of great moment and may not be ignored.

Peter Hall, president of the Hall Planetary Company, has observed over years of experience that most damage is done by the fine particles which are worn off the surface of high-speed-steel cutting tools. Its effect is to dull the cutting edge very quickly. This point is made by another metal cutting expert.

Another manufacturer has found that the fine particles that get back into the cutting fluid act as a lap on drills and reamers, wearing away the guide bushings in a multiple set-up, thereby increasing the clearance and reducing accuracy.

From several sources it is learned that the life of the pump in the cutting fluid circuit is greatly affected by the condition of the oil. Thus one well-known manufacturer of turning machines who does not feel that a

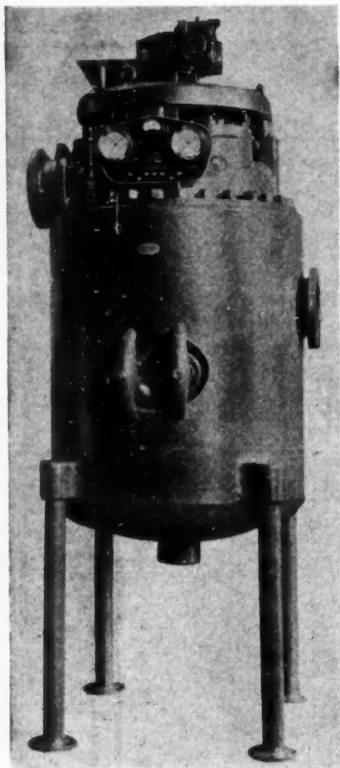
filter is needed on his machines, nevertheless has changed from a geared pump to a centrifugal pump to reduce maintenance. This is a practical demonstration of the presence of foreign material in the cutting oil system and proves the need for better cleaning at least on operations where finish is of primary importance.

Jones & Lamson, however, feel that a filter is not needed in the cutting oil system of a turning machine. Their practice is to use a construction in the oil pan or sump which allows a liberal area for solid matter such as grit and dirt to settle. By following this method they have had no difficulty in using gear pumps for circulating the cutting fluid.

Prof. O. W. Boston of the University of Michigan tells us that in scientific research he goes to the extent of changing the fluid supply frequently, to maintain standard conditions. Obviously, this is neither necessary nor practical in production but it does illustrate the requirements of special conditions.

PART 2. The foregoing discussion is not intended to apply indiscriminately to the many different types of machines used in automotive production. It does apply specifically to certain machines and operations designed to produce fine surface finish in combination with close clearances. Filtering equipment has been recommended for the following types of machines by the contributors to this investigation.

1. Gear lapping and other lapping operations.
2. Grinding, external and internal.
3. Diamond boring, particularly connecting rod and main bearings.



Showing large sump mounted on legs, one large man hole, inlet and outlet

4. Cylinder hones.
5. Burnishing on standard or special machines.
6. High finish sizing reamers.
7. Automatics — by a high grade passenger car plant, also an engine plant. The engine builder is also considering filtering for tapping, boring, and reaming operations.

PART 3. For many reasons, industrial filters for the lubricating or cutting oil systems

of machine tools have not been given much consideration. In fact only a few manufacturers in this field have a product that meets the requirements. Nevertheless, the automotive industry boasts several of the largest centralized filtering systems to be found anywhere.

While it is admitted that the still-pond or settling tank is not adequate for "fine" finish particularly where the volume of flow is heavy, filters are not acceptable unless they meet certain requirements. Chief among these are:

1. How fine particles is it necessary to filter out?
2. Will the filter handle this degree of fineness?
3. What is the flow of oil in gallons per minute? Current practice is approaching 75 to 80 g.p.m.
4. What is the size of the installation required to handle this volume and how much would it cost?
5. Is the filter designed for quick cleaning; is it accessible; does it have replaceable cartridges or cleaning elements? Unless the answer is "yes," the filter will have little chance of adoption.

Among the types of filters that have been tried are the following:

1. Quick cleaning with metal elements.
2. Various forms of felt, hair, and fibre elements, also cotton bags.
3. Centrifugals and separators.

PART 4. Opinions are divided as to whether filtering is best accomplished by equipping individual machines or through the use of a centralized system. No doubt the reason for diversity lies in the differences of plant layout, types of machines, nature of work, and to a large degree the extent to which experimental work has been carried.

Grinders are individually equipped with filters at Plymouth. They are fed either by gravity or pressure, the fluid passing through a single cartridge or a series of cartridges depending upon the volume of fluid to be handled.

We saw a new type of crankshaft grinder recently which was equipped with a bank of four Cuno filters. This is said to handle the volume of cutting fluid satisfactorily.

One of the large manufacturers of high-grade cars has used an elaborate circulating system in the automatic screw machine department. This central system completely circulates and filters all the oil used in this department. It is said to permit the use of a cheaper grade of oil than they formerly used, and cheaper than is generally used, and has shown an appreciable increase in tool life. The system handles 2,000 gallons of oil per minute, which requires an installation of 8 large Cuno filters working in conjunction with a settling tank, pumps, and a gravity tank.

This company also is experimenting with waste type filters but their study has not been extensive enough to determine which type of filter is most effective.

A prominent axle maker is trying out a filtering machine on one of their grinders which seems to be working out satisfactorily. At present these grinders are all provided with a removable bag for catching the grit. Some of the machines have as many as four basins in the compound reservoir, also two bags which seem to catch most of the grit.

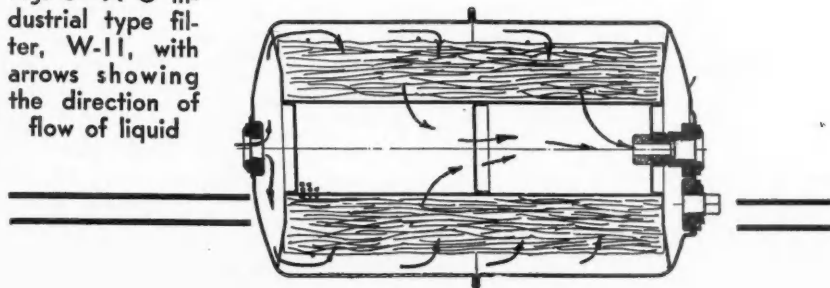
An aircraft engine manufacturer who has installed filters on a number of grinders reports that this step has solved the problem of high finish and has reduced the number of wheel dressings considerably.

We understand that Ford uses a large number of filters handling coolants, cutting oils, and washing machine liquids. These units are in sizes up to 8 in. pipe and are rated up to 1000 g.p.m.

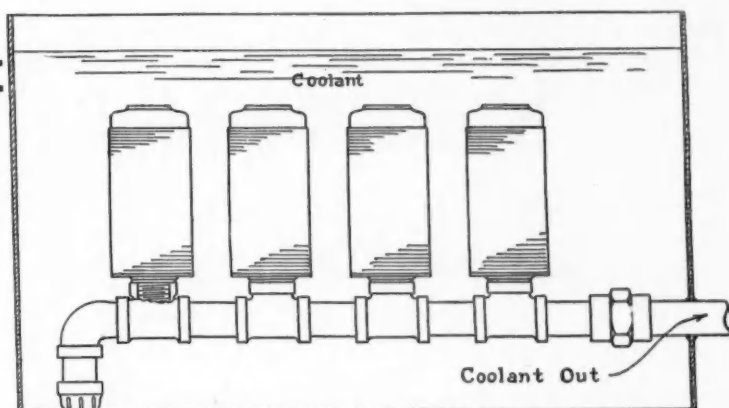
The fineness of the particles to be handled is, of course, an important element in the choice of a filter. One make is designed with openings of about 0.0035 in. although elements with 0.002 openings are available. If the particles to be removed are finer than this, it is necessary to use a cloth or felt element which sacrifices capacity to fineness.

Packard reports that, "The coolant used on our cylinder honing machines is cleaned by a continuous clarification system which is centrally located. In our trials of filters on individual machines, the results ob-

Fig. 3—A C industrial type filter, W-11, with arrows showing the direction of flow of liquid



Motor Improvements, Inc., usually recommends the suction type element arranged as shown in oil sump or tank. The element filters through an outer winding of wire.



tained have not shown enough appreciable difference in finish to warrant additional installations."

Mr. Hall advises that he has developed a new system consisting of both a mechanical filter and a magnetic filter in the lubricating system of the continuous Planetary machine. In recent tests they have been surprised at the amount of steel and iron dust that the combination picks up. Mr. Hall recommends the use of a magnetic filter element for the cutting fluid system.

Youngstown Sheet & Tube Co., one of the largest users of Planetary machines, has a large central filtering department where the oil flows to a very large shallow reservoir, cools, settles, is filtered, and then pumped back to the bank of machines.

PART 5. The elements of economy enter naturally into any production problem. Whether a filter is adopted at all and whether it will be a central system or individual batteries depend entirely upon the controlling conditions. To handle a large volume of oil, it is necessary to provide a sizable battery of filters entailing an appreciable added expense which has to be justified by other gains.

If the fineness of finish is important, the cost of the filter must be assumed as a matter of necessity, since it may not be possible to produce acceptable work otherwise. In this event the cost of the filter simply becomes a part of the initial investment.

But there are other advantages. As mentioned earlier, one is the increase in life of the pump equipment. Another is a saving in wheel dressing because the wheel does not load up so quickly.

Peter Hall says in this connection, "On several occasions we ourselves and other users of Planetaries after making a careful test on similar machines doing similar work have found that the cutter life on a machine, with perfectly fresh cutting oil in it, is just double the life with old cutting oil which is loaded up with high-speed-steel dust which wears off the high-speed-steel cutters. The writer has never heard the argument put up that the reason cutters wear excessively when using old cutting oil is that the oil is filled up with high-speed-steel dust."

CONCLUSION. Despite divided opinions in the matter of filtering cutting fluids, the following conclusions may be well worth noting:

1. The consensus is that fine finish is dependent upon clean cutting fluid.
2. On certain types of machines and operations, particularly where abrasive tools are used, it seems necessary to supplement the usual setting tank with a good filter.
3. The usual settling tank is considered inadequate wherever fine metal particles or abrasive particles may scratch the surface.
4. Some reports indicate a positive economy with filters, due to increase in tool life, less frequent dressing of grinding wheels, less wear and tear on the pres-

sure pump and guide bushings.

5. An acceptable filter must have the following qualifications:

- a. Accessibility and ease of cleaning or replacement.
- b. Capable of handling the desired volume of fluid and filtering to the desired degree of fineness.

6. Filters have been applied on individual machines and centralized installations. The method of application undoubtedly depends upon local conditions.

It is obvious from the activity in various quarters that this matter is of real importance in machine shop practice and merits careful and continued attention. The matter of filtering the cutting fluid is bound to assume greater importance with the growing demand for better finishes.

Symposium on Steel Casting

A symposium on Steel Castings, comprising ten technical papers on various phases of the subject, has been published jointly by the American Society for Testing Material of Philadelphia, and the American Foundrymen's Association of Chicago. The chief purpose of the publication, a book of 254 pages bound in heavy paper covers, is said to be to provide the engineering profession with authoritative information on the properties of steel castings. Carbon-steel and alloy-steel castings are covered.

The first two papers give, respectively, a general survey of the industry and statistical data on steel castings production in the United States. Then follows a contribution on the design of steel castings, which emphasizes the importance of cooperation between designer and founder and discusses contraction and crystallization phenomena under such headings as crystal formation, feeding of sections, effect of heat transmission, deep pockets, linear shrinkage, etc.

A paper entitled "Purchase Requirements for Steel Castings with Notes on Physical Properties in Test Bars and in Commercial Castings" follows.

A technical paper on "Castings of Corrosion-Resistant Steels" gives data on the principal classes of these alloys, covering physical properties at room and elevated temperatures, machining and welding behavior, coefficient of thermal expansion, melting point, maximum temperature for safe use, etc. This contribution also includes a discussion of general considerations affecting alloy selection and outlines the features of the several alloys. Other papers cover austenitic manganese steel castings.

STREAMLINING'S ECONOMIES STRESS ON TRANSMISSIONS

Conflicting Requirements of Economy and Activity Make Solution Difficult

SELDOM have the possibilities of reducing fuel consumption by streamlining and by variations in the rear axle ratio been so impressively stated as in the paper presented by Messrs. Lay, Holton and Patterson of the University of Michigan at the last annual meeting of the S.A.E.

Attainment of the optimum results they picture, however, depends on the use of a transmission not now available in practical form. Moreover, the design of a transmission that will meet the conflicting requirements of maximum economy and maximum activity without adding some unwanted work for the driver, offers obvious difficulties. Assuming that such a transmission does become available, however, its application to conventional cars would result in marked improvements in economy and activity, so it is desirable to differentiate between the gains that are attributable to the transmission and those which are due to streamlining.

In mentioning these aspects of the problem, the writer is not attempting to present any arguments against streamlining, but rather to throw further light on some of the problems involved. Before proceeding further with the discussion, a resumé of certain parts of the paper referred to will be presented.

The authors refer to the need for a continuously variable gear to make it possible to obtain the best results from streamlined cars, with respect to speed, acceleration and fuel economy. They illustrate their reasoning by the example of a small car for which horsepower and fuel-consumption data were available for the whole field of operating conditions. Fig. 1 herewith shows the full-throttle horsepower curve, the corresponding torque curve, and specific-fuel-consumption curves for 4/4, 3/4, 2/4, 1/4 load. In Fig. 2 the specific fuel consumption is plotted against the torque load for different engine speeds. It will be seen from this

that the specific fuel consumption is a minimum and is practically constant over the speed range 1500-2000 r.p.m.; that it increases toward both ends of the speed range, and that it is particularly high at the maximum speed of 3500 r.p.m.

In Fig. 3 the horsepower curve is plotted on a basis of car speed, once for each of the gears in the transmission, together with curves of rolling resistance, air resistance, and total resistance. It will be seen that the curve of total resistance intersects the curve of "horsepower available in direct drive" (4.6 ratio) in a point corresponding to 67 m.p.h., and that is the maximum speed of which this car is capable.

The authors now assume that by suitable streamlining the air resistance is cut in half, and it may be

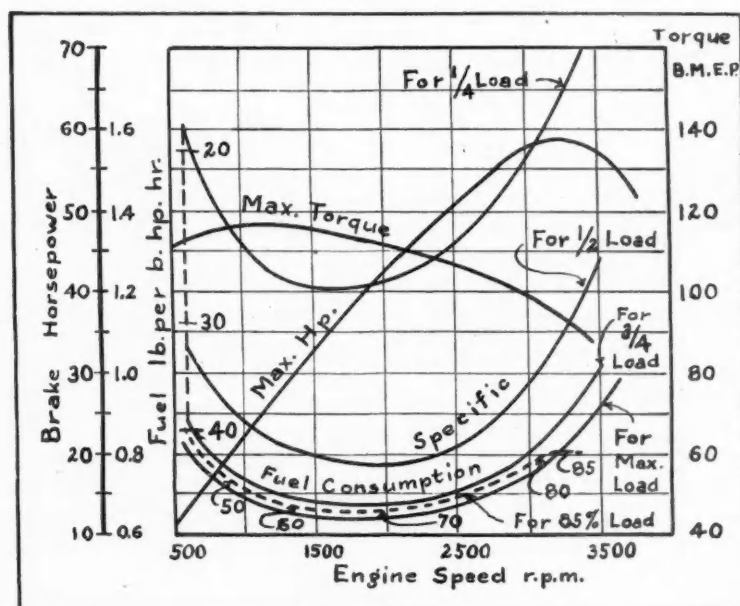


Fig. 1 — Performance curves for a typical small-car engine

PUT NEW PROBLEM

by P. M. Heldt

Engineering Editor
Automotive Industries

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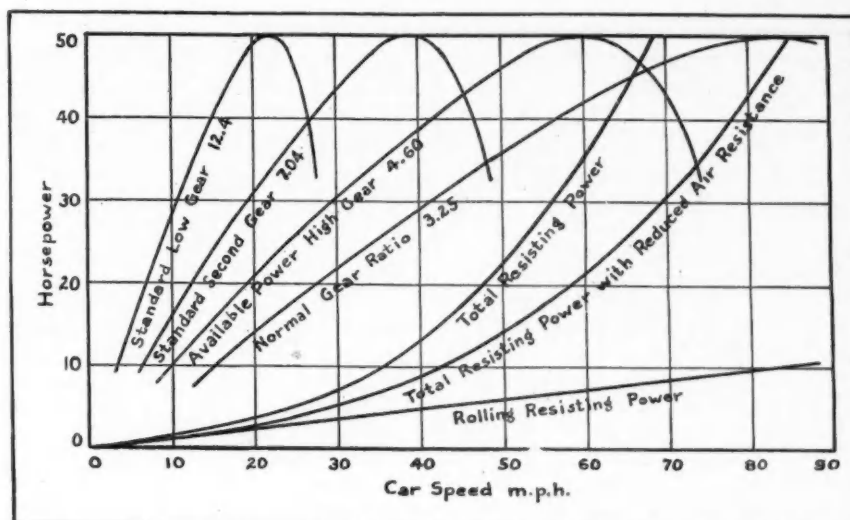


Fig. 3—Power consumption and available power in various gears

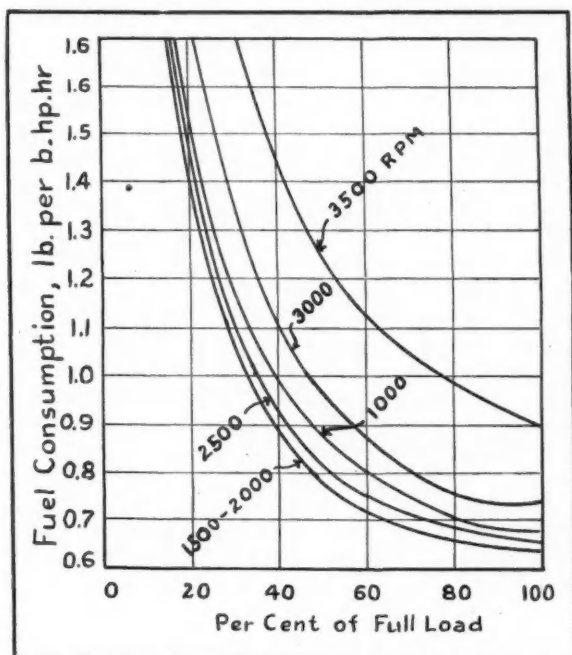


Fig. 2—Fuel consumption of a small-car engine at constant engine speeds

pointed out in this connection that wind tunnel tests made by them with numerous different car models, indicate that this is well within the range of possibility. The curve of horsepower required by this streamlined car intersects the curve of available horsepower at 74 m.p.h., so that without any other changes, only 7 m.p.h. could be gained by the rather radical streamlining required; and, besides, the engine would have to run at far beyond its peaking speed, which would certainly not be conducive to longevity.

Properly to take advantage of the reduction in air resistance it is necessary to reduce the driving gear ratio, so that the engine will operate at a higher load factor, and the authors selected a gear ratio of 3.25 to 1, which they call the normal gear ratio. With this ratio the horsepower-required curve intersects the horsepower-available curve at 85 m.p.h., and this top speed is attained without operating the engine beyond its peaking speed.

In drawing the curves, the efficiency of the transmission and drive was assumed to be 85 per cent in all gears. This makes the maximum horsepower available at the wheels the same in all gears, but these horsepowers, of course, are available at different speeds with the different gears. At any fairly low speed the horsepower available in excess of that needed to move the vehicle on a level road is much greater in the lower gears. At 20 m.p.h., for instance, this excess power available for acceleration or hill climbing amounts to 17 hp. in high, 27.3 hp. in second, and 45 hp. in low gear. For best acceleration and best hill-climbing ability at any speed, a gear ratio must be chosen which moves the peak of the horsepower curve to the vertical representing that particular speed. This at once suggests a variable transmission permitting of changing the gear ratio in small increments over a wide range. With such a transmission the maximum output of the engine, 50 hp., is available at all car speeds.

Assuming that such a transmission is available, the authors next discuss the problem of the best gear ratios for each speed and condition of operation (1) for best car activity and (2) for best fuel mileage.

The term "best car activity" is not defined, but evidently is intended to mean a condition of operation under which the maximum power of the engine is developed. It is obvious that for best fuel mileage the engine must operate under nearly full throttle all the time. It would have to operate under full throttle to meet this condition, were it not for the fact that most carburetors possess the characteristic of automatically enriching the fuel mixture when the full-throttle position is approached. Besides, the engine is likely to be somewhat rough under full throttle, and for these reasons the authors chose a throttle opening of 85 per cent in the following example.

The problem is to find the engine speed and the gear ratio which will give the greatest fuel mileage when driving the streamlined car at 60 m.p.h. on a level, and what the fuel mileage will be. From Fig. 3 it is seen that the power required to drive the car at 60 m.p.h. is 21 hp., and with a transmission efficiency of 85 per cent, this corresponds to an engine output of $21/0.85 = 24.7$ hp. Further, since the engine is supposed to

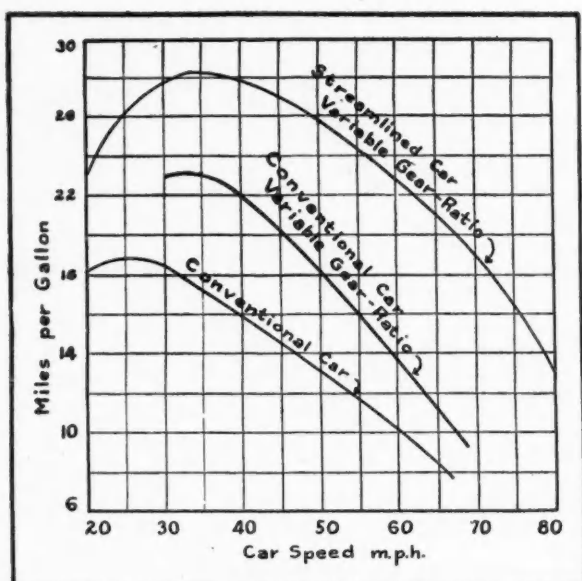


Fig. 4—Fuel mileage of conventional car, of streamlined car with variable gear ratio and of conventional car with variable ratio

be operating at 85 per cent of full throttle, the corresponding engine power at full throttle is $24.7/0.85 = 29.2$ hp. This, as shown in Fig. 1, corresponds to an engine speed of 1320 r.p.m. The latter is 57.5 per cent of the engine speed (2295 r.p.m.) necessary to obtain the same car speed with the normal gear ratio (3.25), and the proper gear ratio to use therefore is $0.575 \times 3.25 = 1.87$.

At very low car speeds the engine speeds computed in this way become too low for smooth operation, and for this reason it is proposed that the engine speed be limited to a minimum of 600 r.p.m., and that for car speeds requiring less power than that developed by the engine under 85 per cent of full throttle at 600 r.p.m. the throttle be closed farther.

Now, what will be the fuel mileage when the car is driven in this way? From Fig. 1 it may be seen that with the engine operating under 85 per cent of full throttle, its specific fuel consumption is 0.67 lb. per hp.-hr. Since it is developing 24.7 brake horsepower, the consumption per hour will be $24.7 \times 0.67 = 16.55$ lb., which at 6.25 lb. per gallon is equal to 2.64 gallons. This will drive the car 60 miles, and the fuel mileage therefore is $60/2.64 = 22.7$.

Applying this same method to the calculation of fuel mileages at other speeds, the values plotted in Fig. 4 are obtained. The gain due to streamlining will be seen to be by far the greatest at high speeds. The intermediate curve for the conventional car with variable transmission has been added to the chart as presented in the paper, to show how much of the saving is due to streamlining and how much to the transmission. It will be noted that the transmission accounts for approximately half of the saving at 35 m.p.h. As speed increases, the proportion of the saving due to streamlining naturally rises, being roughly 80 per cent of the total at 65 m.p.h.

The authors also calculated the most desirable gear ratios for maximum acceleration at all points of the speed range and for maximum

fuel mileage on level road, and these values are plotted in Fig. 5. It is pointed out that for maximum acceleration the most desirable gear ratio approaches infinity at low speeds, and since with the engine at 0.85 per cent of full throttle the driving wheels would begin to spin with a very moderate gear ratio, they limit the ratio to a maximum value of 12.5. It will be seen that the gear ratio giving maximum fuel mileage on level road over a wide speed range is about 1.25, as compared with the ratio of 4.6 actually used in the car which served as the basis for these calculations. Fig. 4, moreover, shows that by streamlining to the degree assumed and using a continuously variable gear in such a way as to always load the engine to 85 per cent of full throttle, the fuel mileage over the speed range of 50-65 m.p.h. is increased from 100 to 150 per cent.

Messrs. Lay, Holton and Patterson certainly paint a very alluring picture, and there seems to be absolutely nothing wrong with their figures, but what are the costs at which these economies can be achieved, and is the motoring public willing to pay the price? If means are available for cutting fuel costs in half, why was not something done along this line when gasoline sold at over 30 cents a gallon, and why is not something being done now when, to judge from registration figures, a good many people have to discontinue the use of their cars on account of the cost?

There are really two answers to these questions. The first is that the transmission on which calculated economies are predicated is not available in a practical form. The second, that any advances along the lines indicated in the past have met with very little encouragement from the buying public.

As regards the transmission, it is obvious that it cannot be automatic in operation, but must be hand-operated. From Fig. 5 it can be seen that for any given car speed the transmission ratio must be entirely different for acceleration and for most economical operation on the level, and, of course, the transmission cannot be expected to know whether the driver wants to "hit her up" or to save fuel. This might possibly be partly overcome by providing two regimes, one for

(Turn to page 390, please)

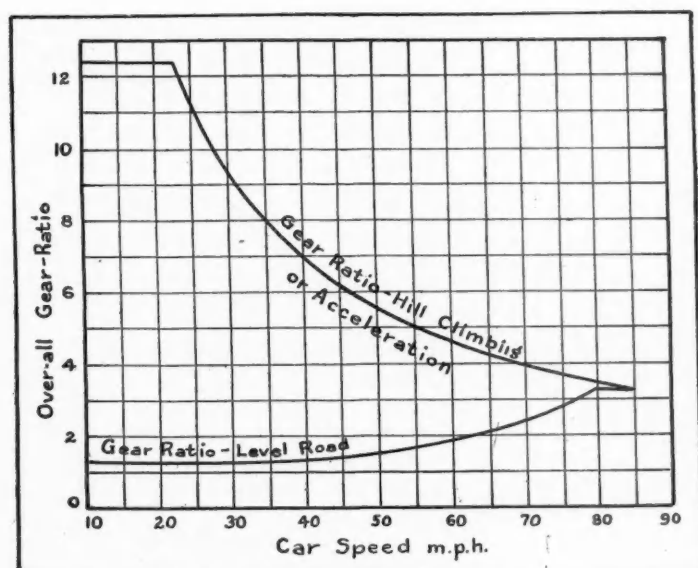


Fig. 5—Gear ratio required for optimum car activity and maximum fuel mileage

New Sampling Indicator Duplicates Closely Cards of High Speed Types

A PRESSURE-SAMPLING indicator for internal combustion engines, which has been developed at Wright Field, Dayton, O., by Ford L. Prescott, senior mechanical engineer there, has now been made available to the industry through the Lawrance Engineering and Research Corporation, New York. It comprises a conventional slow-speed type of steam engine indicator, a sampling valve, and a phase gear. Only the last two parts are new developments.

As may be seen from the illustration, the sampling valve is a compact assembly of conventional elements, including a poppet valve, spring, tappet nuts, rocker and cam. The cavity in which the cam and rocker operate is charged with cup grease.

The valve proper is made of steel and has a lift of 0.007 in. Above the head the stem is reduced in diameter, so that a degree of pressure balance is secured. The clearance so formed also acts as the port from which gas pressure from the engine cylinder is transmitted to a pressure-line fitting in the side of the body.

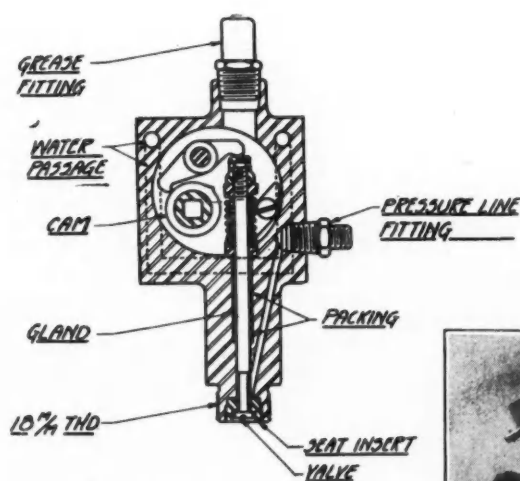
The stem of the valve is sealed in its guide by packing to which oil is supplied under pressure. A line from the engine lubricating system can be connected to a fitting for this purpose at the cover plate which covers the assembly. This sampling valve is screwed directly into the cylinder by means of an 18 mm. thread and wrench grip on the neck.

There is said to be body surface enough on the sampling valve to assure a safe operating temperature of the unit when used on air-cooled engines. For service on water cooled engines, water circulation through drilled passages in the body is required. Two

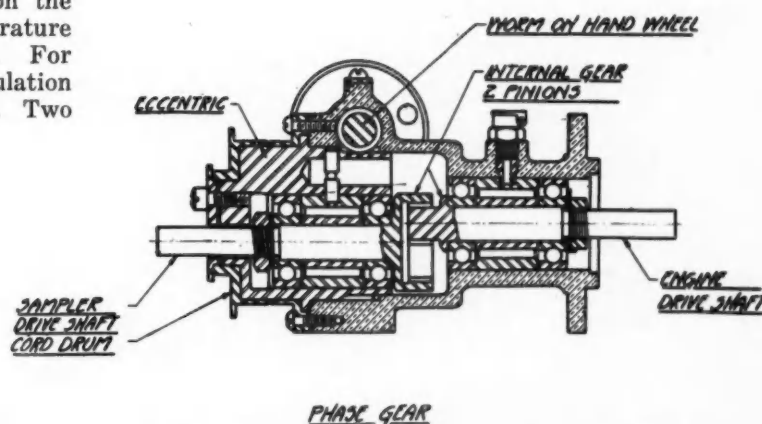
fittings in the form of cover screws allow rubber connection to $\frac{1}{4}$ -in. tubing, in parallel with the engine cooling system.

The sampling valve is driven through a light shaft and universal joints by the phase gear, which is also shown in the illustration. This unit serves to open the sampling valve for an instant, at progressively later points in the engine cycle. It comprises two spur gears—a pinion driven from the engine, usually through chain and sprockets, and an internal gear which has its bearings in an eccentric carrier. The carrier is rotated by a hand wheel and worm, to vary the angular relation of the gear to the pinion through 360 deg., thus changing the phase of the sampling valve through a whole engine cycle.

On the outer end of the eccentric carrier is a cord drum, which is calibrated in degrees to serve also as an index to phase change. The cord from the steam-engine indicator is attached to the cord drum of the phase gear, so that the former acts as recorder of pressure changes sampled at the engine cylinder and transmitted to it through a copper tube of 1/16-in. inside diameter.

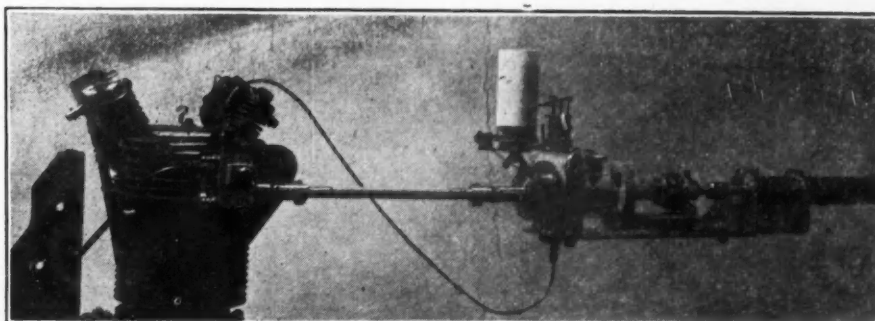


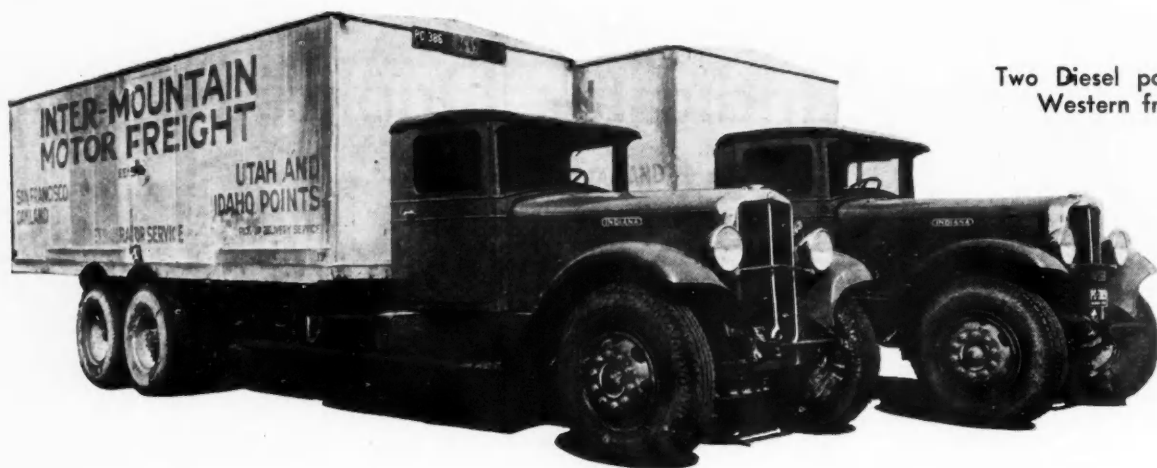
The sampling valve of the Prescott high speed indicator is shown directly above



Above is a sectional view of the phase gear

Prescott high-speed indicator attached to engine





Two Diesel powered trucks in Western freight service

FUEL SAVINGS ASSURE PLACE IN HEAVY DUTY

by Joseph Geschelin

Engineering Editor,
Automotive Industries

FUEL economy is the biggest single reason for the interest in the high-speed automotive Diesel engine. Authenticated reports from various sources, both in this country and in Europe, indicate that heavy duty vehicles equipped with Diesel power are saving about 80 per cent of the fuel cost. The same reports indicate that the Diesel-powered vehicle is covering practically twice as many miles to the gallon as does a similar gasoline-powered job.

Because of fuel economy, and for several other good reasons, the Diesel engine has found favor among many large fleet operators in this country, and some pressure has been brought to bear already upon the manufacturers of heavy-duty truck equipment and buses. Coincident with this, our foreign truck buyers—particularly the lucrative South American market—have begun to insist upon Diesel-engined trucks principally because of an abundance of fuel oil and a correspondingly serious shortage of domestic gasoline stock.

As a result of these developments, the higher executives and the engineers of the various truck units, bus manufacturers, and engine builders are confronted with the necessity of deciding whether or not their company will become identified with this movement. A large group of motor truck manufacturers already have participated in a limited way while several engine manufacturers are busily engaged in developing a suitable power plant.

For the benefit of those who must decide whether or not their organization will participate in this movement,

we have set down some economic considerations that have a bearing on the answer. A thorough understanding of these principles is needed if we are to get an answer to the following questions:

Is there a market for the automotive Diesel engine? What is its extent?

On the basis of the evidence to be presented later, the conclusion is inescapable that the heavy-duty, high-speed, automotive Diesel has a definite, potential market both here and abroad if (1) it can be built for about the same price as similar gasoline engines; (2) it can be built in about the same range of specific weight; (3) it possesses satisfactory performance in the way of acceleration, quick-starting, freedom from knocks and smoke; (4) its economy continues to be better than that of improved gasoline engines.

For the purpose of our discussion we are most interested in Diesel engines suitable for heavy-duty motor trucks from about three tons up. Also for large capacity buses operating fairly long intercity or interstate routes.

Fuel is perhaps the most important single element in the Diesel situation. Since economy is the main reason for the interest in Diesel engines, and since the present order of economy is dependent upon low fuel costs, it is obvious that the immediate success of the Diesel engine depends upon its ability to utilize the present low-cost, abundant fuel. Any other course would defeat its purpose. Yet it is a fact that some Diesel engine designers have ignored or misunderstood the significance of this with the result that a number of designs have contemplated the use of special fuels which would be much more expensive than the available furnace oil.

In an effort to forestall such misunderstanding, a joint committee of the A.S.M.E. and S.A.E. was formed a short time ago to formulate a fuel specification which would be acceptable to oil refiners and, at the same time,

serve as a par for the engine designer. An example of the most practical kind of fuel specifications is that recommended by Cummins, which is said to be broad enough to include the gamut of furnace oils available in various parts of this country, retailing around six cents per gallon in tank-wagon lots.

Fuel tax has been somewhat of a neglected factor. It is obvious that a fuel tax on the Diesel fuel will be imposed just as soon as the usage of Diesel power on the highways becomes appreciable. Therefore, we must be prepared for it and must realize that ultimately at least this part of the difference between Diesel fuel and gasoline will be wiped out.

This question, as well as the economic effect of increased usage of Diesel fuel, leads to the question—what is the future trend in the price of Diesel fuel? There has been much muddled thinking in this connection. In the first place, there is no danger of a fuel shortage if and when we get a large number of Diesel-powered units on the road.

Even if the usage of Diesel power grows by leaps and bounds on trucks and buses, the present price structure should remain comparatively undisturbed. The only way in which we could conceivably upset the fuel situation to

six cents per gallon, without tax. It is interesting to note that in California it is possible to buy fuel oil in 50-gallon drums at four and one-half cents a gallon without tax.

Figures on operating cost are, of course, of great significance. Recent literature abounds in cost figures for European operations. To supplement this material we give below the fuel cost on two California fleets which the writer observed personally, and a third which was recently reported.

Savage Transportation of San Francisco now has in service five six-cylinder Cummins Diesels in Indiana trucks. They carry a gross load of 34,000 lb. on a route of 1616 miles for the round trip. Average m.p.g. for the round trip on the Diesel—7.9; average m.p.g. for the gasoline job—3.4. Reduction in fuel consumption is 100 (7.9—3.4) / 7.9, or 57 per cent in favor of the Diesel.

Diesel fuel costs \$11.96 for the round trip, while anti-knock at 21 cents a gallon at the filling station in foreign states costs \$99.75 with gasoline power. Saving in fuel cost per truck per trip in favor of the Diesel is \$87.79. But since each truck makes six round trips per month, the saving per truck per month on a mileage of about 9000 miles per month is \$526.74.

Purity Stores of San Francisco operates four Diesels, one a four-cylinder Cummins, and three six-cylinder Cummins. The four-cylinder job on a truck-trailer train of 50,000 lb. gross has averaged 10 miles to the gallon over a period of 17,000 miles. The six-cylinder truck-trailers hauling 34 tons gross have averaged better than six miles to the gallon over a combined period of 70,000 miles.

Three gasoline trains doing the same work over the same routes do little better than 3.5 miles to the gallon.

This company buys gasoline at 14 cents a gallon, tax included; fuel oil at three cents plus three cents tax, which they pay voluntarily. On this basis the gasoline train costs four cents per mile for fuel while the Diesel is 0.88 cents per mile. Traveling an average of 5000 miles per month, the cost of gasoline per truck is \$200 per month, while the cost of fuel oil is \$44. The Diesel truck, therefore, saves an average of \$1,872 per year on fuel.

At the annual meeting of the AERA last year, its Rolling Stock Comm. No. 2 reported on the Diesel bus operation of the Capitol District Transportation Co., Albany, N. Y., in which a 20-passenger bus, powered by an 85-hp. gasoline engine, was equipped with a 70-hp. Mercedes-Benz for experimental purposes.

Over a period of about 50,000 miles they obtained the following comparative results: Fuel consumption with the Diesel, 5.33 miles per gal.; with the gasoline engine, three m.p.g. Reduction in fuel consumption, 43.7 per cent in favor of the Diesel.

Maintenance is a moot question. So far as we have been forced to make conclusions on the basis of the performance of European equipment. Haworth and Biggar of England recently reported that the Diesel engine requires a maintenance charge about 47 per cent greater than for the gasoline engine. However, the brief experience in this country seems to indicate a much better order of performance. In fact the experience of Purity Stores, Savage and Capitol Transportation indicates the possibility of approaching closely the maintenance experience for gasoline equipment.

For the purpose of this discussion we have investigated only two technical factors—weight and cost—which have been the subject of considerable argument. Much has been said about the excessive specific weight of the Diesel engine. Accordingly, a comparison has been made on the basis of data on Diesel engines published in "The Compression Ignition Engine" and data on American stock engines from the Statistical Issue of *Automotive Industries*, Feb. 27, 1932. For this purpose we have used the values of lb. for b.h.p. on Diesel engines of 75 hp. and over; 60 hp. and over for gasoline engines. It is important to note that the published data on Diesel engine weight nearly always includes the weight of all accessories, whereas the figures on the gasoline engine show net weight without accessories of any kind.

*Abstract of paper presented before the Cleveland Section of the S.A.E., March 13, 1933.

DIESEL A TRANSPORT

A discussion of the use and prospects of the compression ignition engine in highway haulage service*

the point where Diesel fuel would cost as much as gasoline, or perhaps more, would be if and when every vehicle on the road were equipped with a Diesel engine, which is equivalent to saying that we had reached a point where there was no further demand for gasoline.

However, as the usage grows to the point where the tax will be added on Diesel fuel, the wholesale price of fuel oil and gasoline, obviously, will get closer. And, if future specifications do not demand additional refinery costs, we probably will find a spread of about two cents per gallon between the wholesale price of gasoline and the Diesel fuel.

Another factor in the fuel situation is that at the present time there is no machinery whatever for retail distribution. For some time to come the chief users of Diesel power would be the large fleet operators who would purchase fuel oil in tank lots. However, in most localities, the smaller user can buy fuel oil in lots from 50 to 150 gallons at a somewhat higher price, perhaps not exceeding

By arranging the values of weight per b.h.p. in numerical order, we find that for the Diesel the median or mean value is 16.3, while the arithmetic average is 17.0. By taking the average of the two we get a value of 16.6 lb. per b.h.p. for the Diesel engine.

When the same procedure is applied to the gasoline engine we get a median of 10.6 and an average of 12.7. The average of the two is 11.6 lb. per b.h.p. But the range of values for gasoline engines seems to be abnormally high, being a spread of 4 to 1 between the lowest and the highest. To level this off, we have eliminated the first 10 figures above the value of 9.2. Now the median becomes 12.3, the arithmetic average 14.2, and the average of the two, 13.2 lb. per b.h.p.

Although these averages mean very little, we now have on the one hand a value of 16.6 lb. per b.h.p. for Diesels against 11.6 for gasoline; on the other, 16.6 for the Diesel as compared with 13.2 for gasoline.

On the average, the added weight of accessory items for gasoline engines may run as high as one pound per brake horsepower, for engines of moderate capacity, say around 75 hp. Thus the weight per brake horsepower of the gamut of Diesels becomes only two and a half to three pounds greater—a difference of about 18 to 20 per cent, if we use the corrected average.

When the cost of Diesel engines is considered on a common-sense basis, we get a surprising result. True, the cost of a Diesel engine as compared with a given gasoline engine appears to be abnormally high. But that is because the cost of the Diesel is compared with the cost of high-production gasoline jobs. Compare the cost of a Diesel engine with that of heavy-duty units produced in moderate quantities and you find that they run very close together.

Performance has been the stumbling block to a wider adoption of Diesel engines—at least in this country. In fact, American observers, who have studied European practice, report that the performance of the European equipment would not be acceptable to the truck operators in this country.

Yet, is it safe to judge the Diesel engine merely on this basis? Let us remember that the sole object of European designers was to get economy. Performance was not even considered. Diesel experts in this country, as well as technicians identified with European development, assure us that improvement is possible and can be achieved. Certainly our experience in making the run on the Cummins equipped bus from New York to Los Angeles gave us a high regard for the performance ability of the Cummins Diesel.

Mr. P. M. Heldt, engineering editor of *Automotive Industries*, also assures us that improvement in the performance of the Diesel engine is entirely feasible in the light of recent scientific accomplishment.

Hugo K. Moren, who needs no further introduction in this society, has been very helpful in the preparation of this paper. Writing from his far-off base in Kristienhamn, Sweden, he gives the following specifications for an all-American Diesel engine, which, in his opinion, can be successfully developed. Here it is:

1. Maximum weight of 12 lb. per b.h.p. rated.
2. Maximum speed of at least 2500 r.p.m.
3. Brake mean effective pressure of at least 90 lb. at 2000 r.p.m.
4. Fuel consumption of at least .40 lb. at three-quarter load and 1500 r.p.m.
5. Cold start by hand without aid of electrical means.
6. Combustion without knocks at all engine speeds and loads.
7. Combustion without smoke and unpleasant smell at all speeds and loads.
8. Combustion giving good pick-up and flexibility together with fixed injection timing at all engine speeds and loads.
9. Practical and simple manufacturing and service proposition.
10. Selling price of not more than 25 per cent higher than equivalent gasoline engine in same quantities.

H. L. Horning says in recent correspondence that Ricardo's comet head is yielding 110 b.m.e.p. and 0.41 lb. per b.h.p. hr.

Finally, we come to the question of what is the market for the Diesel engine. This is rather difficult to estimate, and we are forced to generalize to the extent of saying that for the present the market probably will be found on trucks from three tons and upward and buses of heavy capacity. Another way of analyzing the market, however, is to consider that U. S. Registration of trucks of 2½-ton capacity and over was 228,367 units in 1932. World registration of vehicles of the same capacities was 66,188. The total registration of buses is 174,528. Then the grand total of the three categories yields a potential market of about 469,000 units.

Of course, the actual market narrows down to those units that can show an appreciable economy under present conditions. That is to say, the vehicle must save enough on fuel to pay for the added cost of the Diesel engine within a year or year and a half. The present indication is that on heavy-duty operations there is a potential saving of two to three cents per mile at the present level of fuel prices. Yearly mileage must be great enough to pay for the added cost of the Diesel engine out of this saving.

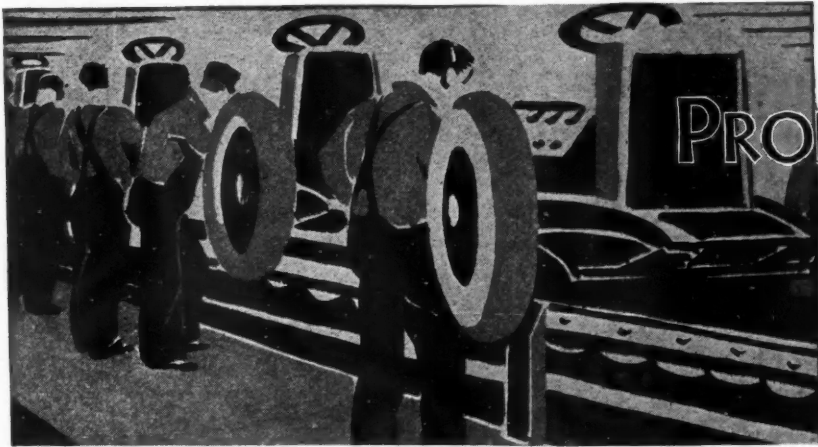
Although a formal announcement cannot be made at this writing, we can safely mention the fact that many of the outstanding engine builders in this country are spending considerable time and effort in development of a Diesel engine for heavy-duty transport service.

The development of these engines will be helped materially by the availability of fuel injection systems like the Bosch and the Compur, which are now available, and a number of other makes which may be placed on the market shortly.

In conclusion, may we emphasize the original premise that fuel economy is the chief reason for the interest in Diesel engines? Although at the present time the cost of the Diesel engine is high, the cost of the fuel very low, and there is a possibility of paying for the added engine cost out of fuel saving. After the engine has been paid for, the saving actually becomes an appreciable part of the earning of the vehicle.

Now as the usage of the Diesel engine grows and grows, we shall expect to find a change in the fuel price to the extent that it will approach the wholesale price of gasoline with tax included. However, it is hardly conceivable that the fuel price structure could change sufficiently without a correspondingly heavy increase in the production of Diesel engines. If this is true, then we shall find that the production cost of the Diesel engine will have decreased considerably and that the fuel savings need not be as high in order to save the revised price of the engine.

TEST runs made by German engineers in hilly territory with motor buses, passenger cars and a motorcycle with side car showed that the temperatures of the brake drums of conventional buses and passenger cars, with the engine unclutched, do not exceed atmospheric temperature by more than 415 deg. F. In the case of a motorcycle with side car a temperature rise of 630 deg. F. was noticed when the rear wheel brake was used alone. In the two buses with which tests were carried out, the weight/friction-area ratios were 21.8 and 17 lb. per sq. in. respectively; in the two passenger cars the ratios were 15.6 and 17 lb. per sq. in. respectively, and in the motorcycle the ratio was 40 lb. per sq. in. One observation made during the tests was that there was always a slight difference between the temperatures of the brakes on the right and left hand sides. This must be due to differences in either the coefficients of friction or the pressure with which the shoes are applied.



PRODUCTION LINES

Centralization

Whether or not we like centralization in general, there is one place in particular where it is needed, in the opinion of many people. That's in the grinding of cutting tools. No matter how you look at it, the cutting tool can make or break the effectiveness of the most expensive machine. Yet the handling and re-grinding of tools still remains a necessary evil, a sort of stepchild. Recent literature is replete with cases that show the economy of centralizing tool grinding, the introduction of good methods, correct grinding wheels, and the utilization of the best available grinding equipment. Think it over.

99.99 Per Cent Pure

That describes zinc as made by the New Jersey Zinc Company. In an unusual article in the *Review of Reviews*, our friend Tom Maloney tells some things about zinc that few people seem to know. Although widely used in industry and growing constantly in importance in the automobile industry, it has been a "forgotten metal." As a matter of fact, in 1931 it ranked third in sales in metric tons of non-ferrous metals; in volume, measured in cu. ft., it was first, with copper, lead, and aluminum, following in order.

Roller Chain Facts

A comprehensive handbook of engineering data, tables of sizes and prices, and some examples of applications form the backbone of bulletin No. 31 issued by the Morse Chain Co. As you might suspect, it's all about Morse roller chain drives for the many places where chain is useful.

Good Work

A handsome as well as informative series of illustrated folders has been designed by the Allegheny Steel Co., to familiarize everyone with what goes on in the making of sheet steel and other products of the steel mill. The fourth one of the series of six has just come over our desk. If you would like to see what a 4-high continuous mill is like, be sure to ask for this bulletin.

Water Trap

Word reaches us that several people have found it difficult to get a good lacquer finish because of water in the compressed air lines. Several commercial separators were tried without success. Then they installed a disc-type filter—and the trouble disappeared. Incidentally, the filter bowl is found to contain water, so that there is no doubt about its presence. If you have had a similar problem, we shall be glad to tell you where you can get the filter mentioned here.

Get Set

J. N. Smith of E. F. Houghton makes some pertinent suggestions on the inspection and reconditioning of leather belt drives which have stood idle for some time. Among other things you should check the following: Is the belt saturated with oil or covered with dirt? Are there any open laps? Is the length correct? Examine fasteners for wear and breakage. Check alignment of pulleys. The remedy is obvious. The important thing is to insist upon the inspection.

About Streamlines

Looks as if the railcar might be the best place to test out the current theories on streamlining. Normal speeds are rather high. Some lines are operating between 55 and 65 mph. At least one high-speed line boasts of 80 mph. and does it consistently. However, the thing that started us thinking about it, is that a prominent builder of railcars has just taken an order for an articulated, two-car job to run at about 90 mph. Where they used a 125 hp. power plant to operate around 55 mph., they expect to use 500 hp. for 90 mph.

At Last

Have you had trouble keeping cement floors clean-looking despite the effects of grease, oil and grime? Anyhow you can relax. Magnus has just come out with a cement cleaner and renovator. It cleans, bleaches, hardens, and fills the surface. Thus, the floor becomes less porous, picks up dirt less readily, doesn't dust.

Symposium Shines

Looking back on the *Symposium on Motor Lubricants* which was reported in *Automotive Industries* last week, we feel that it deserves special mention here because of its unusual significance. Not only was it a National meeting drawing some of the most important figures in the automotive research field, but in addition it was designed as a joint convention of the A.S.T.M. and the S.A.E. Cloyd M. Chapman, distinguished president of the A.S.T.M., opened the first session, while Dr. H. C. Dickinson (our own doc), president of the S.A.E., opened the evening session besides acting as the speaker at the dinner. T. C. Smith of A.T.&T. wielded the gavel with great gusto at both sessions which is record of some kind for technical meetings.—J. G.



This is the second of a series of articles by Dr. Wichtendahl, the first of which appeared in the March 18, 1933, issue of *Automotive Industries*

WHAT

by Dr. Ing. R.
Wichtendahl

THE test run with the NAG-Protos showed plainly that in spite of a very pronounced tramp, which according to the foregoing calculations should produce strong shimmy forces, the front wheels were practically free of shimmy. Measurements of the caster and pivot inclination on the seven different makes of car (see *Automotive Industries* of Oct. 1, 1932) showed many different axle settings, and the question naturally arose whether caster might have an effect which would compensate for that of the gyroscopic moment. This point was discussed at length by Kauffmann, but it will bear further investigation.

As is generally known, the axle and the wheels can be set in a number of different ways. The factors to be considered are negative caster, neutral position, positive caster, inclination of knuckle pivot, and wheel lever arm. If the steering knuckle is pivoted perpendicular to the plane of the axle (Fig. 6) the axle may assume the three positions of negative caster, neutral, and positive caster. In the neutral position the center point of ground contact of the wheel describes a circular arc around the axis when the wheel is swung

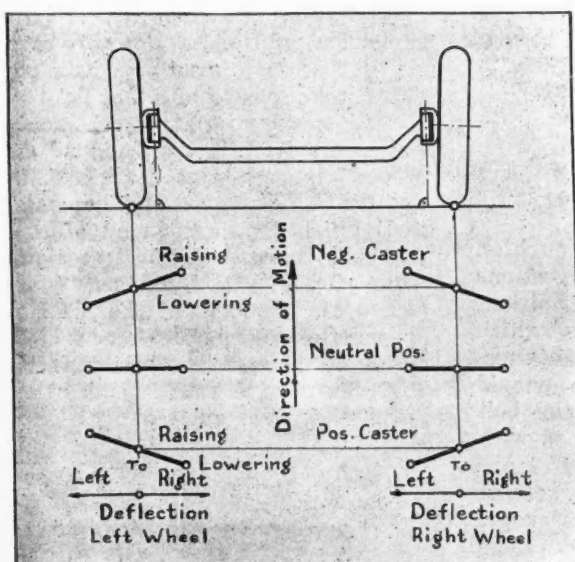


Figure 6

March 25, 1933

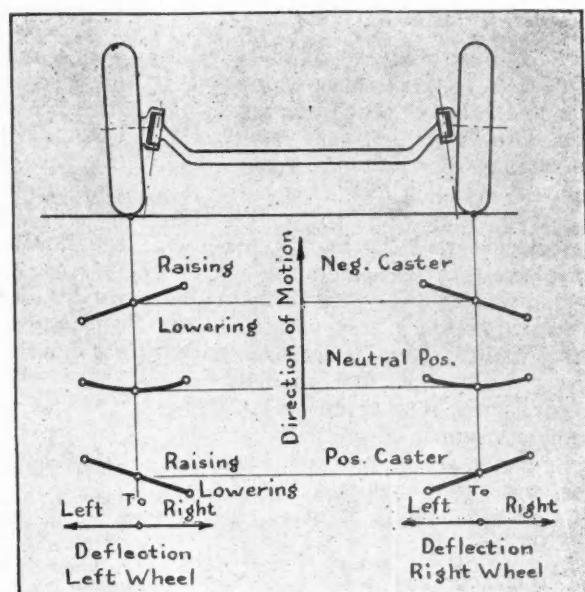


Figure 7

around, without the axle being raised or lowered. With negative caster, if the wheels are swung to the right the axle is lowered at the right and raised at left. Disregarding the unequal deflection of the two wheels, the lowering of the axle on the right and its elevation on the left are equal, so that the height of the center of gravity of the axle remains unchanged. When the wheels are swung to the left the effect is the exact reverse. Also, positive caster has the reverse effect of negative caster. Fig. 6 shows the behavior of the axle in principle.

If the steering knuckle pivot is inclined in the vertical plane of the axle, as shown in Fig. 7, the axle motion with either positive or negative caster does not change in character, but there is a change if the axle has no caster. In that case the axle is raised whether the wheels are swung to the right or to the left. Consequently, deflection of the wheels involves the expenditure of an additional amount of energy necessary for raising the axle and car, and the weight of the car tends to return the wheels to the straight-ahead position and therefore stabilizes the car, provided the steering gear is not self-locking.

The axle motions indicated in Figs. 6 and 7 occur

Automotive Industries

MAKES 'EM SHIMMY?

only if the wheel has a lever arm around the knuckle pivot axis. If there is no such lever arm, the character of the axle motion changes. It would lead too far if all possibilities were to be considered here. The arrangement involving an inclination of the knuckle pivot axis in the plane of the axle, a wheel lever arm, and no caster, occupies a special place among the many possibilities, as it is the only one with which the weight of the car has an appreciable restoring effect on the front wheels.

To determine these restoring forces and moments accurately, it would be necessary to resolve the forces according to pivot inclination and wheel deflection. In order to obtain a general idea of the order of magnitude of these restoring forces in a simple manner, we will make the following assumption: As shown in Fig. 8, let the pivot axis be arranged vertically, and to compensate for this deviation from actual conditions, let the wheel, when deflected, run up an imaginary inclined plane. This would cause the axle to be lifted, the same as it is as a result of the inclined position of the knuckle pivot. From this we get directly a restoring force dependent on the car weight G and the inclination α of the plane — $R = G \sin \alpha \cos \alpha$. The restoring moment is then dependent on the wheel lever arm.

$$M d_r = R a$$

In Fig. 9 the restoring moment is shown graphically as dependent on the wheel load G , the wheel lever arm a and the angle α of the imaginary inclined plane. Values applying to the NAG-Protos car investigated are inserted. For an angle of $\alpha = 8$ deg. there would be a restoring moment of 120 lb.in., which is not nearly sufficient to compensate for the gyroscopic action. Nevertheless, the axle setting referred to has (in my estimation) a special importance from the standpoint of wheel shimmy, as will be explained in

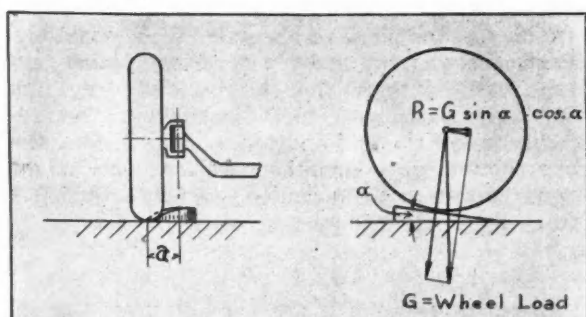


Figure 8

PART TWO

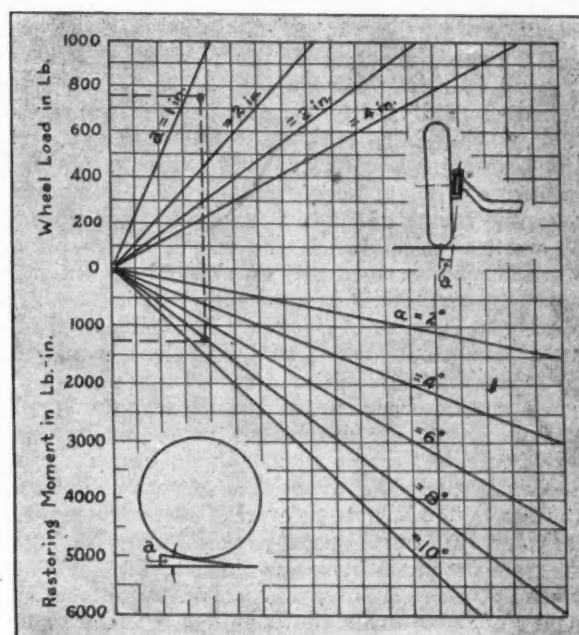


Figure 9

detail further on. In test runs with the electric vibration recorder, negative caster reduced the shimmy in every case. The same observations were made by Becker, Fromm and Maruhn, and especially by Kauffmann, in their investigations. Kauffmann also took into account the effect of the unequal deflections of the wheels on opposite sides, on the distances through which the axle ends are raised and lowered, which was neglected in the preceding considerations, and found that with negative caster of about 2 deg. the height of the center of gravity remains unchanged, whereas with larger negative casters the axle is slightly lowered. However, in his investigations, shimmy disappeared as soon as the negative caster reached 2 deg.

The above facts, I believe, can be explained as follows: As in the steering mechanism investigated by Kauffmann, there was a wheel lever arm (nothing is said on this subject in connection with the investigations of Becker, Fromm and Maruhn), and the axle motions indicated in Figs. 6 and 7 apply. The usual sequence of events in the case of axle motion is as follows: A wheel drops into a pothole, and the next moment the wheel and the axle end are thrown up-

ward. (Fig. 4b. See March 18, 1933, *Automotive Industries*.) This involves an increase in ground pressure, due to the reaction of the more-than-normally deflected chassis spring. If now the left wheel, for instance, is projected upward, it follows from what was said in the foregoing that the wheels will be deflected toward the right. According to Figs. 6 and 7, with positive caster, the left wheel has a tendency to deflect toward the right, since the left end of the axle is lowered when the wheels deflect toward the right. With negative caster, therefore, in case of a deflection toward the right, the left end of the axle must be raised. Hence the effect is contrary to that due to the gyroscopic moment, and it is possible that in the case investigated by Kauffmann an equalization of moments occurred from 2 deg. negative caster on.

Play in Knuckle Pivot as Antidote for Shimmy

As already mentioned, the NAG-Protos car investigated had considerable play in all of the steering joints, including the bearing of the knuckle pivot. This was in sharp contrast to the Hanomag, in which the pivot pins were fitted quite closely. In order to minimize the gyroscopic moment it is important to keep the factor $d\phi/dt$ in the equation for the moment as small as possible. If the wheel, in case of an upward shock described only an upward movement, without any oscillation around axis B-B' (see Fig. 4a, March 18 issue of *Automotive Industries*), the factor $d\phi/dt$ would be equal to zero, and there would then be no shimmy as a result of a gyroscopic moment. This wheel motion occurs in the Lancia design of front axle and in a suitably designed type of oscillating axle. But a certain amount of play in the knuckle mounting makes it possible with an axle of conventional design (as shown in Fig. 10) for the wheels to move vertically upward and not participate in the oscillation of the axle produced by a one-sided shock. With a distance between bearings (b in Fig. 10) of 5.6 in. and a play of 0.040 in. in the bushings, there may be free angular motion between wheel and axle corresponding to the equation

$$\tan \alpha = 0.040/2.8$$

from which it follows that

$$\alpha = \text{about } 1 \text{ deg.}$$

As the vibration records taken on test runs showed the normal axle motion to be about $2\frac{1}{2}$ deg., in case

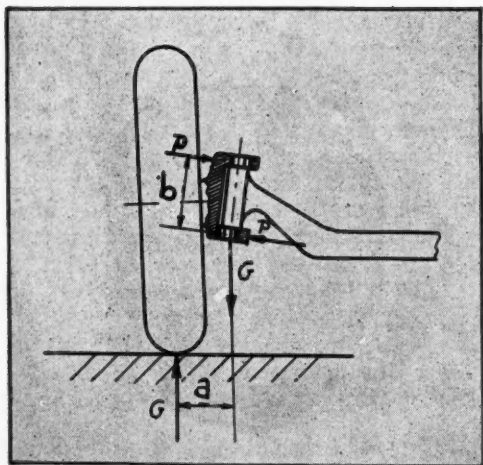


Figure 10

March 25, 1933

of a severe shock (2 in. rise) about half of the axle motion may take place without giving rise to any gyroscopic effects. Only after the play has been taken up, after a rotation of about 1 deg., will the wheel be turned through the pivot guide, and a gyroscopic effect take place. From the records of the test run with the NAG-Protos it may be seen that in case of quite severe shocks were there slight signs of wheel shimmy.

Unfortunately, it was impossible for me to have the NAG-Protos fitted with new, close-fitting bushings, and to thus obtain experimental confirmation of my deductions.

If there is such play in the knuckle pivot, either intentional or unintentional, the wheel lever arm a, by reason of the moment $Ga = Pb$, assures that the knuckle always occupies a definite position. Therefore, the special axle setting already described in this case too will assure good stabilization of the steering gear in the straight-ahead position. With a vertical knuckle pivot the same moment Ga is present; in that

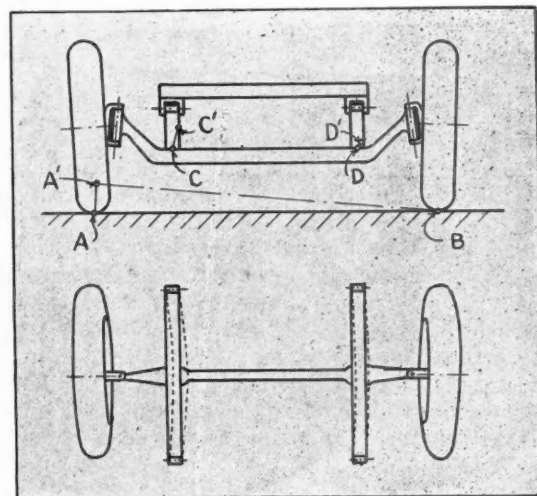


Figure 11

case, however, the steering mechanism would not be stable in the straight-ahead position, because the axle is not raised. In the literature of the subject, the viewpoint has been commonly expressed that play in the steering parts increases shimmy. I believe to have proven that in the special case considered here the reverse holds true.

After a new axle had been made for the Hanomag, with knuckle pivots inclined 7.5 deg., I purposely had the pivot bushings filed out so much that there was 0.060 in. play in the plane of the axle. Unfortunately, the experiment was not entirely beyond criticism, because the ball joints in the tie rod and drag link could not quite participate in the relative motion between wheel and axle, and abutted. Nevertheless, the test runs showed quite smooth operation; only slight deflections to one side occurred, which apparently were traceable to the cause mentioned.

Shock Absorbers as Antidote for Shimmy

As is generally known, the effect of shock absorbers is based on the principle that the axle is practically

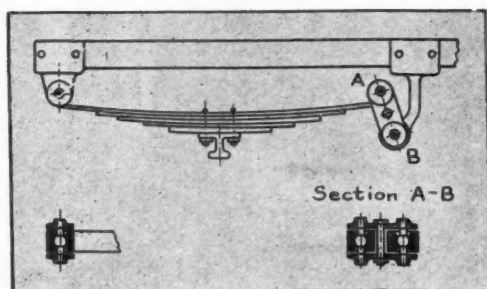


Figure 12

attached to the frame, hence cannot drop into a pothole, and the consequent projection of the wheel from the pothole also is reduced. This reduces the factor $d\phi/dt$. This advantage, unfortunately, has to be paid for with a disadvantage. While the wheel is virtually carried across the pothole by the shock-absorber action, the reaction draws the frame downward. A moment later the upward shock to the wheel occurs, which tends to move the frame upward again. This promotes a whipping motion of the fenders and radiator.

Loose Spring Connection as Antidote for Shimmy

In the case of a one-sided shock to the wheel, the following relations hold true: Suppose the left wheel receives an upward shock. In that case (see Fig. 1, March 18 issue *Automotive Industries*) the point of ground contact A of the left wheel describes a circular arc around the point of ground contact B of the right wheel and is carried to A'. But the points of attachment C and D of the two chassis springs to the axle also must describe circular arcs around B, and thus pass to C' and D'. This results in a double deformation of the springs. In the first place, owing to the lateral motion of points C and D, there occurs a transverse bending of the springs (plan view, Fig. 11), and, secondly, on account of the inclination of the central portion of the spring secured to the axle, toward the two ends secured to the frame, the spring is twisted. As a result of this double elastic deformation of the springs, the axle tends to return to its normal position more violently after a shock. The factor $d\phi/dt$ therefore becomes larger, and hence also the gyroscopic moment. A loose connection of the spring permits the ends to adjust themselves without stress to the changed mean position of the springs, thus softening the gyroscopic action.

Spring Bushings Removed

Originally this loose connection was obtained with simple means by merely removing the bushings from the spring eyes, so that the spring bolts had bearings in the spring eyes with large play. Test runs made with this arrangement showed great reduction in the amplitude of shimmy.

The two test runs with loose spring connection in the provisional form (Figs. 19 and 20 in *Automotive Industries* of Oct. 1, 1932) showed one difference in that while Fig. 19 indicates greatly reduced shimmy amplitude as compared with previous test runs, Fig. 20 shows a practical absence of shimmy. The differences in conditions between the two runs were as follows:

Fig. 19. Slight knuckle pivot inclination (about 2 deg.), close fit of knuckle pivot, no shock absorber.

Fig. 20. Considerable inclination of knuckle pivot (about 7.5 deg.), slight play at knuckle-pivot bearing, with shock absorber.

Although both runs were made on the same course and at the same speed, in Fig. 20 the oscillations of the axle ends are much smaller and not so sharp as in Fig. 19, which indicates that the means dealt with in the foregoing paragraphs as antidotes against shimmy had the desired effect.

To get a better line on the loose spring connection, the springs were provided with spherical bearings instead of with the ordinary plain bearings. The arrangement used is clearly illustrated in Fig. 12 herewith, and evidently prevents all distortion of the springs. For reasons which had nothing to do with the subject in hand, these springs were not fitted into the regular test car, but into another shimmying car with the following characteristics:

1. Steering gear not irreversible.
2. Knuckle pivot inclined 7.5 deg.
3. No caster.
4. Wheel lever arm of $1\frac{3}{8}$ in.
5. Slight play in knuckle pivot.
6. With shock absorber.

Test runs made with this car showed it to run absolutely smoothly on poor roads, at low as well as at high speeds.

Fig. 21 of the previous article (Oct. 1, 1932, *Automotive Industries*) shows considerably more motion of the axle ends than Fig. 20. In this connection it should be pointed out that the NAG-Protos car, with which Fig. 21 was obtained, is a considerably larger and heavier car than the Hanomag, and its chassis springs are relatively softer, which explains the greater motion of the axle ends. In my estimation, in the case of the NAG-Protos, the considerable play in the knuckle pivots contributed most to the elimination of shimmy.

Conclusions

The preceding discussion of the causes of shimmy is based on the assumption that in the case in hand, gyroscopic action was the root of the evil, and any attempted cure must be directed toward preventing the gyroscopic action, that is, the rapid deflection of the wheel from its plane of motion. That shimmy was prevented by the antidotes discussed is shown by the results of the test runs, even though they may not furnish absolute proof (since other unknown conditions may have had an influence).

In all of the literature on the subject with which I am familiar, it is recommended to make the pivot inclination such as to give a very small wheel lever arm, which has become necessary, particularly since the introduction of front-wheel brakes. I believe, however, to have clearly shown in the foregoing that the pivot inclination plays a very important role in combating shimmy, since the application of the antidotes mentioned is predicated on it.

I am convinced that my discussion forms only a small contribution to the difficult problem of shimmy. I have driven a number of different cars with oscillating axles in which, by reason of the design, there could be no gyroscopic effects, and yet shimmy was not completely absent. It is therefore necessary to deal with each case separately.

Studebaker Plants Resume Manufacture As Friendly Receivers Take Control

Court Names Bean, Hoffman and Vance—Delay
in White Merger Precipitates Action—Rockne
Included but White and Pierce not Affected

SOUTH BEND, IND., March 22—Studebaker plants reopened here Tuesday, following the shut down necessitated first by the national banking holiday and continued following acceptance by the directors of Studebaker Corp. of a friendly receivership on March 18.

Despite the receivership proceedings, the corporation received more orders for cars on Tuesday, March 21, than on any previous day since the reopening of the banks. This fact, together with letters and telegrams from distributors throughout the country, indicates, according to Paul G. Hoffman, vice-president of Studebaker Corp. who has been made one of the receivers, an actual increase in morale of the dealer organization and full confidence on the part of the public in the continuity of Studebaker's operations.

In addition to Mr. Hoffman, Harold S. Vance, also a vice-president of Studebaker, and A. G. Bean, president, White Motor Co., were named as receivers by Hon. Thomas W. Slick, judge of the Federal court.

Neither the White Motor Co. nor the Pierce-Arrow Motor Car Co. are affected by the receivership action. Studebaker's only interest in these companies, officials state, is that of a stockholder.

Extension of the friendly receivership was made to include Rockne Motors Corp. of Detroit in an action which took place on March 21.

Immediately following announcement of the receivership, officials of the corporation stated that the action had been consented to, despite the strong financial condition of Studebaker, as the best means of protecting the interests of Studebaker owners, creditors, dealers and stockholders until certain legal aspects of the proposed merger with the White Motor Co. have been adjusted. An attempt was made several weeks ago, it will be recalled, to consummate the consolidation through the United Truck Corp. Due to the opposition of holders of about three per cent of White common, who were dissatisfied with the offer for their holdings, this did not succeed.

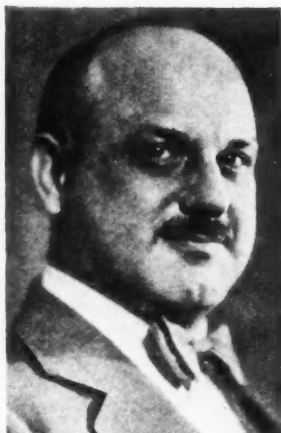
The Studebaker Corporation issued \$14,900,000 in notes in connection with the acquisition of the assets of The White Motor Company. As a result of the attitude of the small minority group, these assets of White have not yet been merged with those of Studebaker. Furthermore, the terms under which these notes were issued have made it impossible, in the present banking situation, for Stude-

baker to secure its customary financial accommodations.

Amplifying this expression, an official statement said in part:

"The Studebaker Corp. and its subsidiaries, including the White Motor Co. and the Pierce-Arrow Motor Car

(Turn to page 384, please)



Studebaker Receivers—Harold S. Vance, A. G. Bean and Paul G. Hoffman

New Goodrich Tire

AKRON—A new automobile tire, incorporating a construction change which is said to protect against blow-outs, is announced by The B. F. Goodrich Co. The major improvement is a ply made of a special compound which resists internal heat and friction, according to Goodrich engineers, and thus prevents separation of rubber and fabric.

Falls Workers Strike

AKRON—Workmen of the Falls Rubber Co. went on strike today in protest against wage reductions that have been made since the first of this year. The Falls company is a branch of the Master Tire & Rubber Co. Workers at the Cooper Corp., Findlay, Ohio, another branch of the Master Tire company, started the strike yesterday.

Seiberling Cuts

AKRON—Tire price reductions of 2½ to 10 per cent were announced here today by the Seiberling Tire & Rubber Co. The reductions were made, company officials said, to meet the Firestone Tire & Rubber Co. reductions of Feb. 1.

February Sales Close to 75,000

Bank Holiday Reduces Car
Sales 22% Under Last Year
—Truck Sales About 9000

PHILADELPHIA—February registrations of new passenger cars in the United States amounted to about 64,500, against 83,000 a year ago and approximately 78,000 in January of this year, according to estimates based on the first 25 states to report. The decline from last year amounts to 22 per cent and from January, 1933, to 17 per cent.

On the basis of these partial returns, Chevrolet leads the passenger car field with 22,800; Ford was second with 9500 and Plymouth third with 7600. In comparison with February a year ago, Chevrolet is off 20 per cent, Ford 1 per cent and Plymouth is ahead 74 per cent.

R. L. Polk & Co., on the basis of returns from 20 states, estimates truck registrations in February of 9000 units. The indicated combined total of new car and truck registrations in February, therefore, is 73,500.

WS

G. M. and R. F. C. End Bank Muddle

**Provide Capital for New
Detroit Bank—40% of Old
Deposits to Be Available**

DETROIT, March 23—General Motors president, Alfred P. Sloan, Jr., announced today that the new National Bank, for which his corporation and the R. F. C. provided the capital, would open for business on March 24 in the former quarters of the First National Bank. Negotiations regarding the amount available to depositors in the two former banks, the Guardian and the First National, have not been completed as yet with the conservators of these institutions.

After five weeks of financial chaos, Detroit this week at last began to see daylight in its banking muddle, with the definite announcement of formation of a new bank to take over the more liquid assets of the First National Bank and the Union Guardian Group. Mediator in the final conferences preceding this announcement was Alfred P. Sloan, Jr., president of the General Motors Corp., which took over the responsibility of either subscribing to or securing subscriptions to \$12,500,000 worth of stock in the new institution, the "National Bank of Detroit." The remaining \$12,500,000 in the form of preferred stock is being subscribed by the R. F. C.

It is expected that General Motors Corporation will offer its stock to large depositors and also stockholders in both former banks. General Motors decision to take this step apparently has been based on inability of reaching a common accord between major interests in Detroit as to the financial set-up of the new bank.

It is understood that President Roosevelt had expressed the desire to see the major industrial interests in Detroit all represented in the new bank, and G. M.'s move does not preclude such participation. It merely

(Turn to page 385, please)

Industry Back in Production as Sales Rebound Sharply from Bank Holiday Lows

Retail Volume Continues Below Last Year But Exceeds Earlier Expectations of Factories

DETROIT—Automobile sales which nationally hit new low levels during the week of the national bank holidays, rebounded sharply last week, the average gain being in the neighborhood of 40 per cent, as compared with the previous week, early reports indicate.

A further gain is anticipated during the present week, but figures, of course, are still lacking. Truck sales similarly, while remaining at comparatively lower level than passenger cars, have also retrieved some of the ground lost during the first 10 days of March, early reports indicate.

Sales for the week ending March 18 for both passenger cars and trucks, however, remained well below the level of last year, in spite of the sales flurry which appeared following the reopening of banks.

Sales are rather spotty, although the good spots are well distributed. The east, including Philadelphia, New

York and Boston have shown proportionately better gains than the midwest, although Chicago is among the bright spots. The coast also has been showing a good improvement in sales.

Detroit manufacturers are remaining conservative as yet in their outlook, although most manufacturers express surprise that sales for the first two weeks of March have not been as bad as anticipated earlier. Production is getting under way slowly in most plants. Studebaker, closed down since before the Michigan holiday, will be getting under way again this week in some departments. Federal Motor Truck is another company getting into limited production again after a protracted shutdown. Other companies which have not been closed as long have either resumed limited production or will have done so by the end of the week. The local Ford plant is still virtually closed down.

Tire Makers Move to Steady Market

**Three Makers Reduce Lines
to Two and Adjust Prices**

AKRON—In a move to stabilize competition and to reduce manufacturing and distribution costs, Goodrich and United States have both announced the elimination of all lines of tires except their first and second grades. Goodyear also is conforming to this policy and will produce only its All-Weather and Pathfinder lines in the future.

Goodrich at the same time announced price reductions amounting to 20 per cent under its September list which would place its prices about 10 per cent above mail order prices on first and second line tires. The actual reduction in retail prices, of course, will be smaller than this figure indicates due to the recent wave of price-slashing in the field. U. S. and Goodyear prices will be competitive.

The reductions follow a cut by Firestone early in February which was met by the mail order houses at that time.

Firestone has made no announcement concerning his plans, but the trade believes that he will take no action for the time being. The mail order companies are expected to take the same attitude. If these expectations are realized, these moves should help to stabilize prices and to end the vicious price warfare that has characterized the tire business for several months.

Concentration on two lines of tires instead of three, four or five will simplify both manufacture and distribution and reduce their cost. Goodrich estimates that the move reduces the number of sizes and types by 35 per cent which will permit substantial reductions in dealer inventories and handling expenses. In addition, purchasing of tires will be less confusing for the customer with only two lines, as it will be easier for him to make intelligent comparisons.

The U. S. line for passenger cars will include the U. S. Royal and U. S. Peerless, and for trucks the U. S. Royal heavy service.

Tire Manufacturers Resume Production

AKRON—All tire manufacturing companies here had returned to normal production schedules this week, following two weeks of sharply curtailed production brought on by the banking holidays.

Goodyear and Goodrich which operated only two to three days a week during the banking crisis were back on four to five-day schedules. Firestone, which sent its production departments on a week's vacation during the holiday, also was back on its regular schedule.

Seiberling and Mohawk rubber companies, which were closed for more than a week, reopened today. General, India and the Falls branch of Master Tire & Rubber Co. also announced they have returned to regular schedules.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

The banking structure last week made progress toward normal operations, and confidence was therefore greatly strengthened; but no marked improvement in actual trade levels accompanied this development. The forced abstinence from buying in some cases during the holiday did result in an improvement in some lines of retail trade when the banks opened. Also, buying has been stimulated in some quarters by the belief that prices are as low as they will be for some years to come.

Food Prices Drop

According to the Bureau of Labor Statistics, retail food prices in the United States on February 15 showed an average decrease of about 4 per cent below those a month earlier and one of about 13 1/4 per cent below those a year ago.

Payrolls Increase

New York State factory employment during February increased 1.4 per cent, as compared with the usual increase in that month of 1.2 per cent. Total payrolls increased 1.3 per cent during the month, as compared with an expected rise of only 0.7 per cent.

Power Production

Production of electricity by the electric light and power industry of the United States during the week ended March 11 was 9.6 per cent below that a year ago. Production during the preceding week was 6.4 per cent below that a year ago.

Cotton Consumption

Cotton consumed during February in the United States amounted to 488,133 bales, including linters, as against 519,-

614 bales during the preceding month and 505,473 bales a year ago.

Crude Oil Production

Average daily crude oil production for the week ended March 11 amounted to 2,115,850 barrels, as against 2,147,900 barrels for the week before and 2,145,600 barrels a year ago.

Fisher's Index

Professor Fisher's index of wholesale commodity prices during the week ended March 18 stood at 56.1, as against 55.0 two weeks before. For the week ended March 11 no compilation was made because many of the commodity exchanges were closed as a result of the bank holiday.

Stock Market Revives

The stock market opened last Wednesday for the first time since the banking holiday was enforced. Prices of active stocks opened from three to ten dollars above their previous close. The advance continued until the latter part of the next day, when profit taking set in; but the advances for the most part were well maintained. Bond prices also moved upward, as did quotations on produce markets.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended March 15 showed decreases of \$182,000,000 in holdings of discounted bills and of \$140,000,000 in holdings of bills bought in the open market. Holdings of Government securities increased \$18,000,000. The reserve ratio on March 15 was 49.1 per cent, as against 45.6 per cent a week earlier and 53.5 per cent two weeks earlier.

Sterling-French Company Organized

DETROIT—The complete organization is announced of the Sterling-French Machinery Co. of Detroit. Charles E. French, president; T. C. McDonald, formerly with Reed-Prentice and National Automatic Tool Company; J. E. Livingstone, Michigan representative for the American Broach Company; D. B. Burleigh, vice-president and formerly sales manager of the Sundstrand Machine Tool Company. The

company will handle production machine tools in the Detroit territory and Province of Ontario, where a branch office will also be maintained.

Dashiell Liquidating

CHICAGO—The Dashiell Motor Co., Dodge dealer here since 1914, is liquidating its business. The change is due to the unsettled conditions existing in the industry, and is being made with the full agreement and cooperation of the factory, the bulletin of the Chicago Automobile Trade Association says.

Canadian Output Was 3298 in February

Declines Less Than Two Per Cent from January

OTTAWA, ONT.—Production of 3298 automobiles in Canada during February, a short month, showed little change from the 3358 cars of the previous month but was 40 per cent below the output for February, 1932, when 5477 cars were made. February figures, when compared with those for January, show that passenger cars registered a slight improvement to 3025 from 2921, while trucks declined to 273 and 437.

Of the February output 3130 cars were made for sale in Canada, leaving a balance of 168 for export. The apparent consumption of cars in Canada during the month, as determined by adding the 3130 cars made for sale in Canada to the 99 imported, amounted to 3229 cars. Exports for the month were reported at 277 cars.

A Correction

Due to unfortunate typographical errors, the second paragraph of the article entitled "European Diesel Makers in Drive for Export Markets" by A. W. Childs, chief of the Automotive Division, Department of Commerce, was not punctuated correctly, thus destroying its sense. The paragraph in question is reprinted here properly punctuated.

"Not only are Diesel trucks being used or experimented with in the well known places of the world,—but also in the smaller, more distant or undeveloped sections. From distant Ethiopia, a French firm has received an order for a truck to be used for experimental purposes; in Ceylon, Java, Philippine Islands and Puerto Rico, a German company has secured some business; in the Canary Islands, Iraq, India, Singapore and South Africa, the British are said to be making progress; in Palestine and Peru, the Swiss have sold a few machines; in China, The China General Omnibus Company (Shanghai) operates nearly 100 British Diesel-powered busses; while the Diesel type of vehicle is a commonplace on the streets of London, Paris and Berlin. In one of the cases cited, that of Java, it is reported that a dealer handling German vehicles took orders for 30 trucks within 30 days after obtaining that dealership."

5000 Diesels in France

WASHINGTON, D. C.—The outstanding development in the French truck field has been the rapidly increasing popularity of Diesel engines. About 5000 vehicles using this method of power are now in circulation in France, according to the Department of Commerce.

Philippines Offer Good Diesel Market

Demand Is for Two and Three-Ton Capacities

WASHINGTON, D. C.—Development of an important demand in the Philippine Islands for two and three-ton trucks powered by Diesel engines is foreseen by automotive interests in the Islands, and American truck and engine manufacturers should study these prospects carefully, according to a radiogram to the Automotive Division, Department of Commerce, from Trade Commissioner E. V. Hester, Manila.

German and British automobile manufacturers who have already made progress in developing trucks powered with light Diesel engines are understood to be studying the Philippine market prospects. Both of these countries are manufacturing trucks of this type and have been active in endeavoring to develop an important export trade in them. Several British and German companies have been successful in securing some fairly important orders in markets of the Far East and Africa.

Brookings Publishes Transportation Book

WASHINGTON, D. C.—The facts in back of the recent report of the National Transportation Committee, of which the late Calvin Coolidge was chairman, are presented in a book entitled the American Transportation Problem, published by the Brookings Institution, which collected data for the Committee. It provides a comprehensive survey of the entire transportation system, and those concerned with legislation will find it valuable. Copies may be secured from the Institution, which is located in Washington, D. C. The price is \$3.

Houdaille Reports for 1932

DETROIT — Houdaille-Hershey Corp. and subsidiaries sustained a net loss of \$590,523 in 1932 as compared with a net profit of \$226,232 in the previous year. Current position was well-maintained during the year as the following comparisons show:

	1932	1931
Cash and Marketable Securities	\$2,038,264	\$1,927,639
Current Assets	2,997,881	3,022,281
Current Liabilities	379,110	413,468
Working Capital	2,618,771	2,603,813

Tire Shipments Gain

NEW YORK—January tire shipments totaled 2,596,585, an increase of 43 per cent compared with December, but 20 per cent less than in Jan-

uary, 1932, according to the Rubber Manufacturers Association.

Production of tires in January totaled 2,257,846, an increase of 14 per cent compared with December, but 35 per cent less than in January, 1932.

Stocks of tires in the hands of manufacturers on Jan. 31 amounted to 7,236,845 units, a decrease of 3 per cent from the total on Dec. 31 and a decline of 9 per cent from Jan. 31, 1932.

England With Auburn

AUBURN, IND. — William E. England recently chief engineer Houde Engineering Corp., and one-time chief engineer of the F. B. Stearns Co., manufacturers of Stearns-Knight motor cars, is now experimental engineer for the Auburn Automobile Company.

New Goodyear Disk Brake for Planes

AKRON—An hydraulic disk brake for airplane wheels has been announced by the Goodyear Tire & Rubber Co. It is based on the principle of the disk clutch, a series of bronze disks being keyed to the airplane wheel and therefore compelled to rotate with it, while a series of alternate steel disks is keyed to the brake structure and is non-rotating. Oil pressure is applied by means of a pedal acting on a master operating cylinder, from which the pressure is transmitted through an oil line to the brake itself, where it acts on a piston that presses the disks together. An oil-line pressure of 150 lb. per sq. in. is used, and the total braking surface is 350 sq. in. The new brake can be installed on new planes and also substituted for other types of brakes on old planes. Goodyear will furnish the hydraulic brake in a complete assembly of air-wheel tire, wheel, brake, master operating cylinder, hydraulic hose and all connections.

Dictators Urged To Raise Prices

Link-Belt President Would Have Dictators Control Industrial and Farm Output

CHICAGO — Selective dictatorial control of agricultural and industrial production to raise prices to profitable levels is urged by George Paull Torrence, president of the Link-Belt Co.

Recognizing that each agricultural commodity is an individual problem, Mr. Torrence would authorize the President to appoint dictators for each major market crop. These dictators would be responsible to or themselves form the Farm Board. They would be authorized to issue marketing licenses to farmers and to limit acreage. Purchasing from unlicensed farmers would be made the subject of penalties.

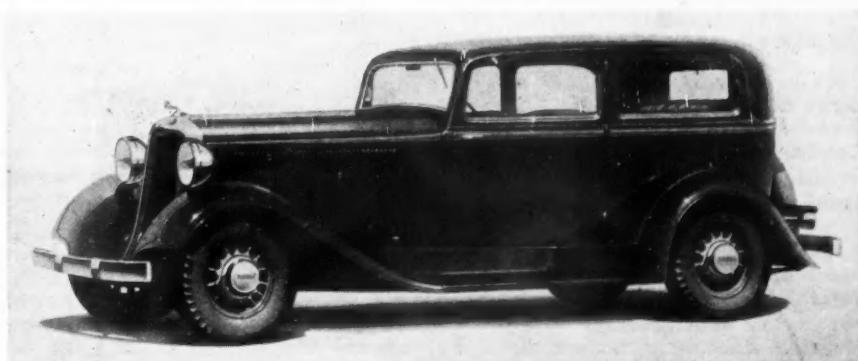
As to industry, Mr. Torrence would exempt industries suffering from excess capacity from the operations of the anti-trust laws and permit them under the supervision of the Federal Trade Commission to cooperate in the limitation of output, in the establishment of sales policies and labor rates, and the fixing of prices. The individual industry through its trade organization would appoint its own dictator to administer the plan.

"Presuming good intention on the part of all concerned and competent leadership," Mr. Torrence says, "the plan will work, but it is wise to confine it to the few industries needing it most until after the technique is developed."

Edward D. Lowrie

DETROIT — Edward D. Lowrie, maintenance engineer for Midland Steel Products Co. for the last 28 years, died March 18 following a brief illness.

Dodge Six, Two-door Sedan Priced at \$630



Studebaker Plant Resumes Manufacture

(Continued from page 380)

Co., which are not included in this receivership, had on Jan. 1, 1933, excluding good will, net assets amounting to \$77,622,293 in excess of all liabilities and a book value, excluding good will, of \$26.22 per share of Studebaker common stock. Of these total net assets, net current assets were \$21,781,243 or \$8.84 per share of common stock. Cash alone was more than \$9,000,000.

"Studebaker's competitive position has been improving steadily. During each of the past four years Studebaker-built cars have secured a larger proportion of total registrations than in the previous year.

"The four lines of trucks—White, Pierce-Arrow, Studebaker and Indiana—now sold by the White Co., showed a larger dollar volume last year than any competing company, except Ford and Chevrolet."

An independent stockholders' protective committee, headed by Monroe Douglas Robinson, has been formed, with the Trust Company of North America, in New York City, named as depository. Included in this committee, which plans a separate investigation of Studebaker's affairs, is G. M. Williams, president of Marmon, George R. Daniels, builder of the for-

mer Daniels car, and W. B. Hurlbert, vice-president, Granville Aircraft Corp. George L. Schein is counsel.

BUFFALO—A credit balance of \$100,000, which Pierce-Arrow owed Studebaker, was attached on Tuesday of this week in a civil action against the latter involving \$1,448,000, brought by Albert J. Carey of Brooklyn. Four notes are said to be based on four notes assigned to Mr. Carey by New York City banks.

NEWARK, N. J.—The Studebaker Corp. and the Studebaker Sales Corp. on Monday of this week were directed to show cause on March 28 by Vice-Chancellor Stein, why receivers should not be appointed for them. The court issued the order on the application of the receiver for the Broadney Corp., formerly the Ira C. Jones Co., local distributor.

CLEVELAND—Formation of a protective committee for holders of the 6 per cent gold notes of the Studebaker Corp., issued in connection with the White merger, was announced here on Monday of this week.

of \$153,000 in the liquidation of the White Motor Securities Corp., which deductions were offset in part by a credit of \$1,004,000 gained through the retirement of common stock purchased at a discount.

The Dec. 31, 1932, balance sheet shows cash of \$7,171,000. A comparison of the current items follows:

	1932	1931
Current Assets	\$19,410,000	\$23,460,167
Current Liabilities	1,096,000	1,353,073
Working Capital	18,314,000	22,107,094

Sales Decline Causes Pierce-Arrow Deficit

BUFFALO—A net loss of \$3,032,430 for 1932, after depreciation, interest, etc., but before preferred dividends of \$106,650, is reported by the Pierce-Arrow Motor Car Co., as compared with a net loss of \$476,943 and dividends of \$576,337 in 1931.

Net sales were \$7,988,956 against \$11,925,657 in the preceding year.

The balance sheet shows total current assets of \$3,063,526, including \$448,102 cash, against current liabilities of \$1,432,230. Notes payable amount to \$700,000. Net working capital is \$1,631,296.

Capital stock and surplus at the year end were carried at \$10,553,907, against \$13,990,446 a year earlier.

Studebaker Reports First Loss for 1932

Current Ratio Is 2.9
Including White Assets

SOUTH BEND—The annual statement of the Studebaker Corp. for 1932 shows that for the first time in its history the corporation operated at a loss. The consolidated profit and loss account, including subsidiaries, except the White Motor Co., records a net loss for the year after depreciation and interest but before dividends of \$8,686,983, against a 1931 profit of \$825,202. Common and preferred dividends paid during the year amounted to \$992,465. Sales declined from \$64,406,858 in 1931 to \$46,233,830 in 1932.

The consolidated balance sheet, which includes the White Co., shows the following as of the year end:

Cash	\$9,644,373
Sight drafts	545,053
Investments	664,693
Receivables less reserves..	4,970,148
Inventories	17,409,569
Total current assets.....	33,233,836

Notes payable	6,291,000
Accounts payable	2,915,946
Total current liabilities...	11,452,593

Working capital21,781,243

March 25, 1933

The plant and property account after depreciation is carried at \$68,267,528; trade name, good will, and patent rights at \$5,388,912. Among the liabilities are \$14,269,200 gold notes due Dec. 1, 1934, or Dec. 1, 1942. Capital stock and surplus accounts show a total of \$75,780,951.

Under the terms of the indenture, the 6 per cent gold notes referred to in the previous paragraph are not due until 1942, provided Studebaker before Dec. 1, 1933, grants note-holders the privilege of converting into Studebaker common after Dec. 1, 1934, at the rate of one share for each \$25 of notes. If this privilege is not granted, notes become due Dec. 1, 1934, unless holders of 75 per cent of notes request the trustee not to make the declaration. Stockholders have been asked to authorize the granting of the conversion privilege at the annual meeting on April 25.

White Motor Reports \$3,618,000 Loss in '32

CLEVELAND—A net operating loss of \$3,618,000 in 1932 is reported by the White Motor Co. against a 1931 loss of \$3,234,956. Surplus was reduced during the year from \$7,979,000 to \$2,087,000 by the operating loss by a dividend of \$5 a share on the common stock and by a loss

Smila Heads A.S.T.E.

DETROIT—William H. Smila, Chrysler tool engineer, has been elected president of the American Society of Tool Engineers. Other officers elected include Frank Hartlop of Timken, first vice-president; T. B. Carpenter of General Motors Truck, second vice-president; A. M. Sargent of Pioneer Engineering & Mfg. Co., secretary; Joseph F. Slavik, Warner & Swasey Co., treasurer. Past-president J. A. Siegel of Packard, has been appointed chairman of the meetings committee.

Aluminum Industries Reports

CINCINNATI—Aluminum Industries, Inc., reports a net loss after taxes and other charges of \$70,889 in 1932, contrasted with net profit of \$134,142 in 1931.

Allied Products Statement

CHICAGO—Allied Products Corp. and subsidiaries report for 1932 net loss of \$174,006 after all charges, compared with net loss of \$95,157 for the year ended Dec. 31, 1931.

Kublin Weds

AUBURN, IND.—George Kublin, chief engineer, Auburn Automobile Co., recently joined the ranks of benedicts.

Automotive Industries

G. M. and R. F. C. End Bank Muddle

(Continued from page 381)

insures an earlier opening of the new bank than would otherwise have been possible.

Mr. Sloan personally has been extremely active in the negotiations with the R. F. C. and the Treasury Department and has spent considerable time in Washington and Detroit in connection with these negotiations.

It is expected that the board of directors to be announced shortly will include officials and representatives of other Detroit industrial interests aside from General Motors. So far it is understood, however, that it has been impossible to secure participation in the banking venture on the part of the Ford Motor Company, and unless such participation is forthcoming it is expected that Ford Motor Company will organize a separate bank in Detroit, as previously indicated in these columns.

It is estimated that approximately 40 per cent of the assets of the former banks will be available to depositors by conversion into currency through the R. F. C. Whether or not this includes the 10 per cent already set aside for depositors remains to be seen.

Conservators will continue liquidation of the remaining assets of the former banks and proceeds, if any, will be made available to depositors. The organization of the new bank does not relieve stockholders in the old banks from liability to assessment.

In underwriting the common stock of the new bank, Alfred P. Sloan, Jr., stated that General Motors was doing so as a contribution towards the settlement of a very serious situation. It had no desire to enter in any way the banking business in Detroit or elsewhere.

With that in mind an offer will be made by General Motors Corporation to all depositors and stockholders of the First National Bank and the Guardian National Bank of Commerce for subscription to the common stock of the new bank, at the same price as paid by General Motors Corporation, that is fifty dollars a share.

Further, Mr. Sloan stated that he was hopeful that as soon as the situation was stabilized it would be possible for General Motors to withdraw entirely, transferring its investment to others to carry on this particular responsibility and duty to the community.

The long duration of the banking holiday has hampered both large and small manufacturers in Michigan. The former have been able to meet the situation by drawing on out-of-state funds, but many of the smaller manufacturers are entirely dependent on local banking facilities. The opening of the newly formed National

Bank of Detroit will relieve the situation materially. However, the liquidation of the two old banks now in the hands of conservators, is quite likely to put many of the smaller manufacturers in a difficult position so far as working capital is concerned, inasmuch as the conservators will use deposits of such companies to offset any loans they may have.

Indiana Export Gains

SOUTH BEND—More Indiana trucks have been exported to date this year than were shipped to overseas dealers during the entire year of 1932, it was announced here today by Arvid L. Frank, vice-president and general manager of The Studebaker Pierce-Arrow Export Corporation.

February Sales Down 8 Per Cent in Ohio

COLUMBUS, O.—Total sales of new passenger cars in 63 counties in Ohio, representing more than 80 per cent of the state's population for the month of February, 1933, were 4090,

which is a decline of 8 per cent from the records of January this year and a decline of 9 per cent from February, 1932. Trucks sold in the same counties during February this year numbered 412, a decline of 24 per cent from the sale of January, 1933, and a decline of 25 per cent from February, 1932.

American Brakeblok Corp.

DETROIT—Effective March 10, the name of the American Brake Materials Corporation, manufacturers of American Brakeblok, was changed to the American Brakeblok Corporation.

The change of name does not indicate any change in policy, and the address of the American Brakeblok Corporation remains 4660 Merritt Ave., Detroit, as in the past.

Spicer Balance Sheet

TOLEDO—Spicer Mfg. Co., according to its consolidated balance sheet on Dec. 31, 1932, had current assets of \$2,025,463 including \$1,122,375 cash, against \$3,112,431 and cash of \$692,671, a year earlier. Current liabilities were \$417,616 at the end of 1932 against \$695,962 in 1931. Working capital amounted to \$1,607,847 as compared with \$2,416,469 on Dec. 31, 1931.

New Canadian Tariffs Reduce Rates on Many Automotive Imports From the United States

OTTAWA, ONT.—Changes in Canadian tariffs announced this week in general appear to be favorable to the automotive industry. In the new schedules which follow, the first tariff rate given is the British preferential, the second is the intermediate, applying to countries with which Canada has trade agreements, and the third is the general applying to countries such as the United States with which Canada does not have trade agreements. The old rates are given in parenthesis.

428D—Magnetos and complete parts thereof, when imported by manufacturers of internal combustion engines, for use exclusively in the manufacture of such internal combustion engines in their own factories: Free, 10 per cent, 15 per cent (15 per cent, 25 per cent, 30 per cent).

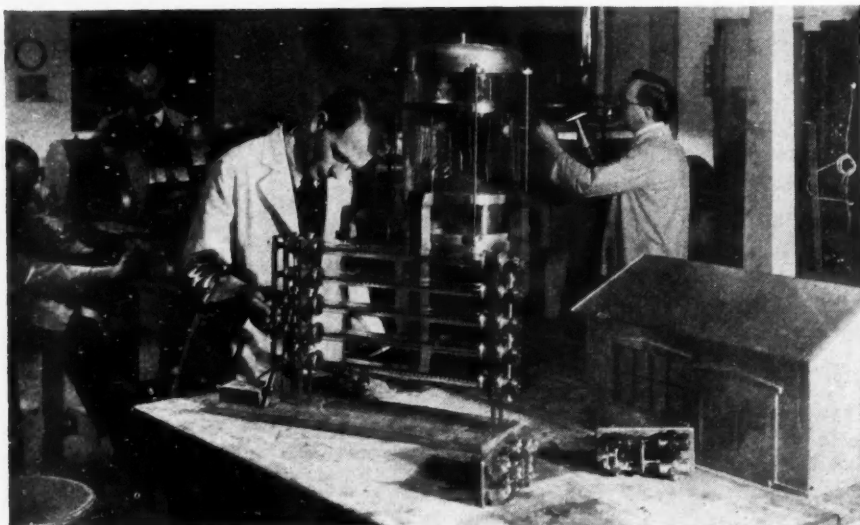
438B—Automobiles for conveying passengers only, N. O. P., valued at retail at place of production, when new, with standard equipment complete, at not more than \$1,200 each; motor trucks with standard equipment (not for use on railways or tramways), not to include machines or other articles mounted thereon or attached thereto for purposes other than for loading or unloading the truck; chassis for motor vehicles specified in this item: Free, 17½ per cent, 20 per cent (free, 17½ per cent, 20 per cent).

438D—Horns, distributors, instrument-

board lamps, oil gauges, gasoline gauges and parts thereof, thermostats, oil filters, carburetors, purifiers for oil, purifiers for air, lock washers, speedometers and parts thereof, vacuum tanks, fuel pumps and parts thereof, composite gaskets of metal and asbestos, steering wheels and rims therefor, one-piece welded axle housings, machined or not; instrument bezel assemblies, dash heat indicators, electric ignition locks, steering gear locks, transmission locks or combinations of such locks and parts thereof, cylinder lock barrels and keys, bearing spring shackles and automatic radiator shutter assemblies, meters, radiator shells, body cowls and body stampings of metal, including front, rear, side and door stampings, not further manufactured than welded or riveted for shipping purposes; all the foregoing being of a class or kind not made in Canada, when imported by manufacturers of goods enumerated in tariff items 438A, 438B, 438C, 438E and 438F, for use only as original equipment in the manufacture of motor vehicles enumerated in tariff items 438A, 438B, 438C and 438F: Free, free, free, (free, free, free and 15 per cent, 25 per cent, 27½ per cent and 15 per cent, 27½ per cent, 35 per cent).

440N—Complete parts for repair of engines enumerated in tariff item 440M: Free, 12½ per cent, 15 per cent (10 per cent, 25 per cent, 27½ per cent). (II) Electric telephone apparatus and complete parts thereof: 10 per cent, 25 per cent, 30 per cent (free, 25 per cent, 30 per cent).

Model Refinery for Century of Progress



Constructing parts of the complete model refinery for the exhibit of the petroleum industries at the Chicago Century of Progress Exhibition. Models of oil fields and geological formations also will be shown

Traffic Managers Study New Loading Devices

DETROIT—New devices for loading automobiles into freight cars were studied by members of the Traffic Managers Conference of the National Automobile Chamber of Commerce at a meeting held in Detroit Friday, March 24, according to J. S. Marvin, chairman of the conference.

The Car Service Division of the American Railway Association, which has been observing the operation of these loading devices that are built into box cars to replace the wooden supports heretofore used for double-deck shipping, has recommended continuing the tests prior to adoption of the device as standard equipment. About 15 railroads have been experimenting with automobile shipments carried in this way.

A special committee of traffic managers of the industry who have successfully used the devices is in contact with railroad officials on the results.

Hudson Advertising Getting Results

DETROIT—The advertising campaign initiated by Hudson-Essex just prior to the bank holiday and sustained during that period without cessation is getting results and has maintained sales even during the period in which the banks were closed, according to word just received from the Hudson Motor Car Company.

For the week ending March 4 sales were 20 per cent higher than for

the preceding week, and while full reports are not yet available for the week ending March 11, substantial gains have been reported from a number of areas during that period.

McCloskey with Taylor

NORRISTOWN, PA.—L. T. McCloskey is now sales manager of Taylor & Co., manufacturers of vulcanized fibre and phenol fibre. He was formerly vice-president and sales manager of the Continental Diamond Fibre Co.

Kilpatrick Named Head of Chrysler Parts Corp.

Becomes General Manager With Kenyon and Ralls as Merchandising Directors

DETROIT—K. T. Keller, vice-president and general manager of the Chrysler Corporation, announces the following changes in personnel of the Chrysler Motors Parts Corporation.

W. H. Kilpatrick is appointed vice-president and general manager. J. L. Kenyon and G. H. Ralls are appointed merchandising directors, reporting to Mr. Kilpatrick.

With the appointment of J. L. Kenyon and G. H. Ralls, as merchandising directors, a much closer relationship will be established between the distributors and dealers and the Motors Parts Corporation, which will be mutually beneficial and will insure that the owners of all cars built by Chrysler Motors will in the future get even better service than they have had in the past.

February Payrolls Drop 23 Per Cent in Michigan

But Work Sharing Holds Employment Practically Even With January Total

DETROIT—Employment in the automobile industry in the State of Michigan totalled 138,524 during February, compared with 139,087 in January and 180,401 in February, 1932. These figures are compiled from reports of 65 companies by the department of Labor and Industry, Lansing, Mich.

Aggregate weekly payroll during February was \$2,251,468 against \$2,920,068 in January and \$4,754,246 in February last year.

Average weekly earnings per capita were \$16.25 in February this year, \$20.99 in January and \$26.35 in February, 1932.

Terraplane Six Sedans Longer

DETROIT—About the first of the year Hudson Motor Car Co. notified its dealers that body dimensions lengthwise on the Terraplane six-cylinder sedan would be increased. This new body has now been put into production and is being announced locally as fast as distribution is achieved and stocks have been cleaned up.

The major change in the body is that the rear over-hang has been increased to give approximately four in. more leg-room in the rear compartment. Draftless ventilation, as adopted in the Terraplane Eight and Hudson Sedan models, also is incorporated in the new six-cylinder sedan. Color options have been increased to include jet black, blue, green, burgundy red and brown.

Wagner Electric Report

ST. LOUIS — Wagner Electric Corp. reports a net loss of \$241,559 in 1932 against a net profit of \$383,469 in 1931. After dividends the 1932 deficit amounted to \$469,541 as compared with a deficit of \$228,012.

The balance sheet shows cash of \$500,678 and U. S. Securities of \$2,280,937. The current position follows:

	1932	1931
Current Assets	\$5,257,637	\$5,753,618
Current Liabilities	178,666	274,011
Working Capital	5,078,761	5,479,607

Bosch Reports for 1932

NEW YORK—The consolidated income account for 1932 of the United American Bosch Corp. shows a net loss of \$1,857,127, as compared with a 1931 loss of \$1,447,253. Sales last year were \$3,004,005 as compared with \$6,323,085 in the previous year.

Kentucky Registrations Down 35 Per Cent from '32

LOUISVILLE—There has been a drop of approximately 35 per cent in the number of automobiles registered in Kentucky this year, as compared with those registered last year up to March 1, while the reduction in truck registration is on about the same percentage, figures of N. O. Gray, head of the State Automobile Department, of Kentucky, would indicate. For 1933 the total of cars was 171,648, as compared with 260,415 last year. Trucks this year were 21,592, as compared with 32,306 last year. This makes a total of 99,481 units not in operation March 1.

Bullard Elections

BRIDGEPORT, CONN.—At the annual meeting of The Bullard Co., held at the company office on March 15, directors elected for the ensuing year included: E. P. Bullard, E. C.

Bullard, D. B. Bullard, J. W. Bray, A. E. North, E. P. Blanchard, H. C. Bullard, J. W. C. Bullard, and T. E. Dunn.

At the ensuing meeting of the newly-elected Board, the following officers were elected: E. P. Bullard, president; Messrs E. C. Bullard, D. B. Bullard, J. W. Bray, vice-presidents; Mr. A. E. North, secretary-treasurer; and Mr. G. L. Todd, assistant secretary-treasurer.

Ainsworth Reports Loss

DETROIT—Ainsworth Manufacturing Co., has reported for year ended Dec. 31, 1932, consolidated net loss of \$220,171 after all expenses compared with net loss of \$144,166 in the preceding year.

Current assets as of Dec. 31, totalled \$1,592,498 and current liabilities \$165,446.

G. A. Ellerthorpe has been elected secretary to fill the vacancy created by the death of W. J. Barr. Other officers and directors reelected.

Timken Bearing in Liquid Condition

CANTON, O.—The consolidated balance sheet of the Timken Roller Bearing Co. for the year ended Dec. 31, 1932, reveals the company in a highly liquid condition. Comparative figures follow:

	1932	1931
Cash	\$1,345,207	\$5,823,036
Marketable Securities..	12,211,173	8,214,330
Current Assets.....	19,055,902	21,487,200
Current Liabilities.....	512,213	1,144,068
Working Capital.....	18,543,689	20,343,132

Dodge Dealers Stay Ahead of Last Year

DETROIT—The banking holiday brought the first break in a 15-week record of expanding sales for Dodge dealers. During the week of March 11, deliveries of Dodge and Plymouth cars were 5 per cent under the previous week, but 30 per cent above the same period in 1932.

Automotive Oddities—By Pete Keenan

Write us if you know an Oddity



COLONEL BARKER
MOTOR SALESMAN OF LONDON, ENG.
CLUBMAN, SPORTSMAN, ATHLETE,
AND MARRIED MAN. WAS ARRESTED
FOR FALSE PRETENCES AND WAS
FOUND TO BE A WOMAN.



**THE SHORTEST AUTO
MECHANIC IN CHICAGO**
3' 6" IS CALLED
R. SMALL.

**WALTER
UPWARD**
74 YEARS OLD
IS THE OLDEST
LIVING AIR-
PLANE PILOT.
United Airport
Los Angeles.



**A
SIGN ON
THE CAR
OF G.B. DODGE**
Cleveland, O.

**DODGE
THE
UNDERTAKER**



**THE SPEEDOMETER READ 11,111 MILES
ON THE 11th DAY OF THE 11th MONTH AT 11:11 A.M. ON
A.P. WAXMANS AUTOMOBILE. New York 1932.**

Steel Market Regains Lost "Holiday" Volume

No Rise in Prices Expected Until Demand Gets Stronger

NEW YORK—Following the unavoidable interruption of routine business as the result of the "bank holiday," the steel market regained this week part of the temporarily lost volume, and confidence is running high that further improvement is around the corner.

Resumption of sheet buying reflected to a considerable extent better demand from automotive consumers. Pittsburgh district mills were reported to have come in for an especially encouraging number of moderate size orders for flat steel. Temporary suspension of one of the leading interest's subsidiary mills in the Youngstown district caused a slight recession in the operating rate in that territory, but this, it is expected, will be more than made up for during the next two weeks.

A good many releases on which postponement of shipment had been asked were reinstated with the request that the steel be forwarded with as little delay as possible. Prices are unchanged. Their future course will be governed by the general movement of commodity prices and the economic situation as a whole. Talk of higher prices for flat steels and wire continues, but it is freely admitted that prices cannot be revised upwards until demand gives evidence of having broadened sufficiently to support such a move.

Steel scrap prices have moved fractionally higher, but whether this portends a stiffening of the finished steel market's price structure remains to be seen, the higher quotations for scrap so far being merely a change in sentiment among scrap iron brokers.

Pig Iron—While the market as a whole is more active, automotive foundries continue to confine takings to nearby requirements. Prices are generally unchanged, but in a number of the markets there is talk of early advances.

Aluminum—Middle West remelters of secondary metal report better inquiries from automotive consumers with quite a little business under actual negotiation. Prices are unchanged, but producers characterize the market as showing a stronger undertone.

Copper—Under the weight of heavy offerings by custom smelters, the market for electrolytic copper receded to 5¼¢. delivered Connecticut, early this week. There being no buyers at 5¼¢ and later at 5½¢, sellers took the bull by the horns and lowered their price to 5¼¢. Copper alloy ingot prices have been revised downward accordingly.

Tin—Decline in Sterling exchange caused the price of prompt Straits to ease off to 24¢ early this week. On March 8, the metal was quoted at 25½¢.

Rolls-Royce in Default on British Contract

SPRINGFIELD, MASS. — Rolls-Royce of America, Inc., in its annual report for year ended Dec. 31, 1932, shows a loss of \$431,527, as compared to \$745,481 for 1931. Deficit at the

To Have License Fees on Old Cars

The legislature of South Carolina is considering a bill designed to provide for taxation of motor vehicles, through license fees, upon the basis of the age of the vehicles. Under the bill vehicles four or more years old shall pay a license fee of one-half that paid by new vehicles. The bill calls also for registration of motor vehicles on Nov. 1 of each year.

end of 1932 was \$2,324,444, as against \$1,921,127 at the end of 1931. Net sales for the year 1932, including chassis, used cars and maintenance, amounted to \$1,276,613, as compared to \$2,049,486 in 1931.

In a statement to the shareholders, President J. S. Inskip says: "Inasmuch as your company is in default on its contract with Rolls-Royce, Ltd., to take a specified number of chassis, any permanent continuance of the business will be dependent upon some arrangement being made with Rolls-Royce, Ltd., which will be satisfactory to them. It is the opinion of the directors that a reorganization on such a basis would of necessity be predicated on securing fresh capital with which to carry on the reorganized company; the alternative being a scaling down of the company's fixed obligations and capital structure in conformity with a reduced scale of operations in a more limited territory than that hitherto covered."

CALENDAR OF COMING EVENTS

MEETINGS

National Machine Tool Builders Assoc. Annual Meeting, Cleveland,	April 24-25
Natl. Foreign Trade Council, Annual, Pittsburgh	April 26-28
U. S. Chamber of Commerce Meeting, Washington, D. C.	May 2-5
American Gear Mfg. Assoc., Wilkesburg, Pa.	May 4-6
Natl. Automobile Chamber of Commerce, Annual, New York City	June 8
Natl. Retail Hardware Assoc., Indianapolis	June 12-16
American Society for Testing Materials, Chicago	June 26-30
Automotive Engine Rebuilders Assoc., Annual, Chicago	July 10-14
Natl. Safety Council, Chicago	Oct. 2-6
National Metal Congress, Detroit	Oct. 2-6
American Petroleum Institute, Annual, Chicago	Oct. 24-26

Court Defers Action on Bankruptcy Plea

Move Opposed by Creditors' Committee and Receivers—Willys Resumes on IHC Order

TOLEDO—Receivers for the Willys-Overland Co. have begun the recall of workmen and had about 1000 workers on the payroll by Wednesday in the manufacture of the model D-4 trucks for International Harvester.

John N. Willys, receiver, who has been ill at his home in Palm Beach, Fla., for several weeks, returned Wednesday to plunge into the task of reorganization.

Employees Monday filed a motion for opportunity to examine the receivers in open court under their move to force a sale of the property and the establishment of a preference for their wage claims. About 8000 workers are included in the group which has engaged counsel.

Solvency of the company has been raised in a petition filed by three creditors through Attorney Max Kahn, Detroit, and the court is asked to modify its original order to permit the filing of a petition in involuntary bankruptcy.

Judge George P. Hahn heard some argument on the matter and expressed regret that the question of solvency had been raised by creditors whose claims were less than \$8000 and under conditions where preference was alleged in a claim of \$29 in a case "so momentous to not only creditors, but to workers in this city."

Judge Hahn has already ruled that the company is solvent.

The petitioners claimed that the Willys-Overland assets amount to \$6,212,000, mostly in materials, equipment and real estate, while they claim that the company owes \$10,273,000 and that the receivers now acting are interested parties.

Attorney Harold W. Fraser, representing the creditors' committee, said the burden of proof lay upon the petitioners and demanded they be put on their proof. He questioned the good faith of the petitioners. He denied every charge. He demanded that the complainants give adequate security for costs to protect the company from costly litigation. He said it had not been shown that the court does not have authority to use its injunctive powers.

Attorney Sigmund Sanger for the receivers declared the petition alleged no act of bankruptcy.

The creditors petitioning for right to file bankruptcy proceedings are the Snyder Tool & Engineering Co., a Michigan corporation with claim of \$6,000; Saylor Electric & Manufacturing Co., a West Virginia corporation with a claim of \$237, and Fred Plumer and Associates, an Illinois corporation, with a claim of \$1,000.

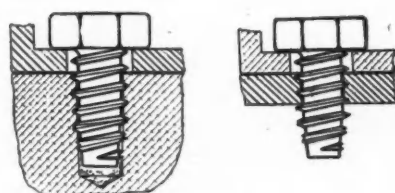
Court action has been continued for a week.

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Parker-Kalon Hex Head Self-Tapping Screws

Parker-Kalon Corporation of New York announces that after three years use, at first experimentally and then in regular production in some of the largest metal working plants of the country, Hex Head hardened self-



tapping cap screws have been made a regular product by the company. These screws form their own threads and therefore eliminate the tapping process. They are extensively used for making fastenings to sheet metal of from No. 24 to No. 10 gage (0.025 to 0.140 in.); to steel plate and structural shapes up to ½ in. thick, and to solid sections of brass, bronze, aluminum, die castings, slate, transite board, asbestos, etc. The screws are made in a complete range of diameters from No. 6 to ½ in. diameter.

Kipp Die Caster

A new series of die casting machines in the low-priced class has just been announced by Madison-Kipp Corp., Madison, Wis. These machines have been designed to meet the special requirements for the economical production of comparatively small parts for the job shop, the small manufacturer, as well as of the large manufacturer who has diversified lines.

These machines are particularly applicable for die casting parts which are now made by methods other than die casting. The series consists of:

Kipp-caster No. 11 for the production of parts in aluminum duralumin, nicalumin, magnesium and similar alloys.

Kipp-caster No. 15 for the production of zinc, lead and tin alloy parts, and

Kipp-caster No. 26 which is a combination of No. 11 and No. 15.

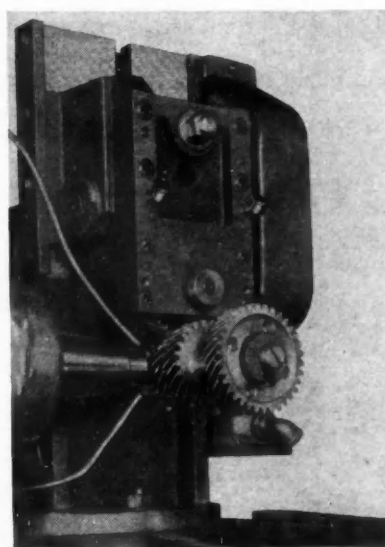
Kipp-caster No. 11 is an undershot machine (metal enters dies from the

bottom at the parting line), having a metal well for hand loading and hand operated plunger mechanism for introducing metal into the die cavity under pressure.

Kipp-caster No. 15 is a side shot machine (metal enters at the side of split-gate dies) and is equipped with an electrically heated metal pot and a plunger loaded metal pressure goose-neck. This machine is semi-automatic in operation.

City Machine Spiral Gear Workhead

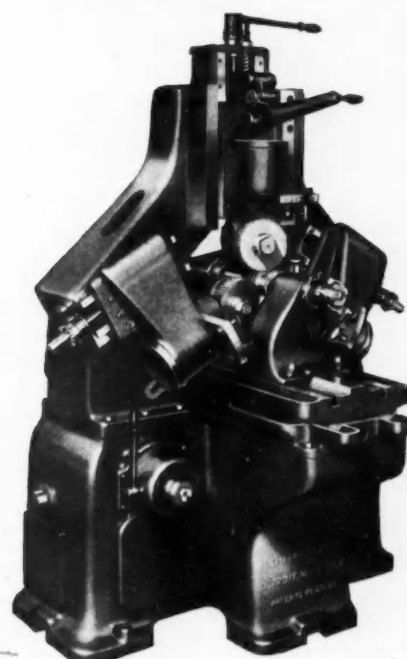
City Machine & Tool Works, Dayton, Ohio, makers of the "Peerless" gear tooth chamfering machine, announce a new improvement to its standard workhead which permits the chamfering of spiral or helical gears on a rapid and economical basis. Developed particularly for helical gears, this improved Cimastool workhead also is adaptable to spur gears and with a slight change can be applied to all No.



3 Peerless machines. Although developed primarily to meet the unusual thrust of spiral gears, it in no way limits the capacity or the flexibility of the machine. With an anti-friction bearing idler drive, the head can be quickly readjusted to meet the varying diameter gears. Actual usage in the field has already proved the performance of this improved product.

Michigan Gear-Lapping Machine

Three laps are used in a gear-lapping machine recently designed by the Michigan Tool Company, 7171 Six Mile Road, East, Detroit, Mich. These laps are spaced about equally around the work. Each one may be set with its axis at an angle to the axis of the work, thereby producing a sliding action between the lap and gear teeth. The upper lap is raised and lowered by means of a handle for loading and unloading the machine.



A hydraulic brake on each lap-spindle may be set to almost any predetermined pressure for speeding up lapping operations. The headstock and tailstock for supporting the work, either between centers or stub arbors, are mounted on a table which is oscillated at various speeds. It is claimed that this insures even lapping throughout the full length of gear teeth. Reloading is facilitated by an 8-inch movement of the tailstock spindle.

The machine is almost entirely automatic. Means are provided in the control box for setting the length of time it is desired to lap each side of gear teeth. The time may be equal for each side, or different. The machine can be set to automatically change from lapping one side of the gear teeth to lapping the opposite side.

Blue Midget Air Grinder

An air grinder, known as the Blue Midget, weighing only 7 oz. yet having a tested grinding speed of 40,000 r.p.m., has been announced by the Madison-Kipp Corp., Madison, Wis. It has been developed to fill the need for a small, yet efficient air grinding tool for all light work and intermittent service.

Streamlining's Economies Put New Stress on Transmissions Problem

(Continued from page 370)

acceleration and hill climbing, the other for economical operation on level roads, the change-over from one to the other being made by hand. But it is difficult to see how the transmission could be controlled automatically within one of these regimes in such a way, for instance, that a decrease in the power of the engine would bring about a change in the transmission ratio so as to restore the maximum-power condition of operation.

If the transmission were to be hand-controlled, in districts where road surface and grade conditions change a good deal, it would have to be shifted or changed continually in order to keep the engine running at 85 per cent full throttle all the time. Besides, the throttle often would have to be closed down for the sake of safety, and this in turn would necessitate a change in gear ratio. Continual shifting is practically unthinkable with a type of transmission which interrupts the flow of power every time a change in ratio is made, and the only other type of mechanical transmission the writer knows of is that involving the use of a roller ratchet or mechanical valve. It is somewhat questionable whether such a device can be made sufficiently compact and durable to meet practical requirements.

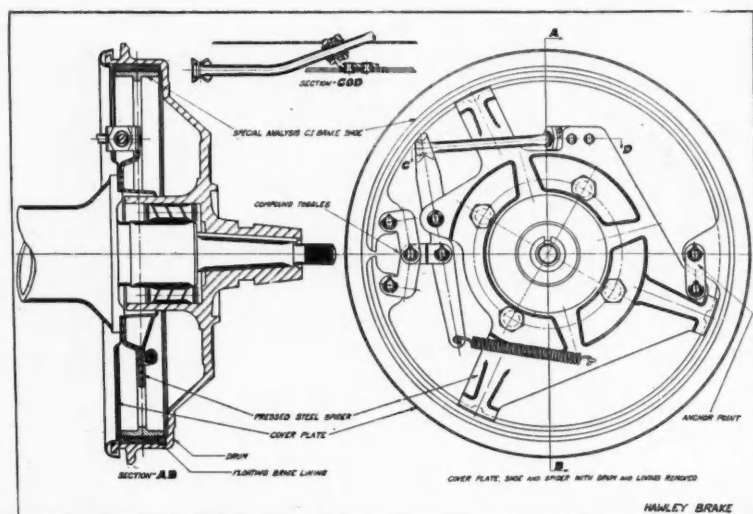
Now as to the public's reaction to "economy features." Past experience has all tended to show that the American motorist will not make any serious sacrifice for the sake of an increase in fuel mileage. One might cite the slight success achieved in introducing European midget cars in this country, but an illustration more to the point is found in the recent

history of the four-speed transmission. Some five years ago four-speed gears were introduced to make practical a lower rear-axle reduction ratio, which latter not only improved the fuel mileage but also saved the engine. The counter argument at that time was that an increase in engine power also would permit of lowering the rear axle ratio. This is perfectly true, and the larger engine, driving through the same lower gear, also would be subjected to less wear and tear. The one thing it would not do was to cut down the fuel consumption.

Well, if we compare 1930 models with those of 1933, we find that four-speed transmissions have greatly decreased in numbers, while engine powers have increased, so the big-engine protagonists seem to have won out in this argument. Apparently the public did not like the more frequent gear shifting required with the smaller rear axle ratio.

Also, while we hear a great deal about streamlined bodies nowadays, the appeal is more to the artistic sense than to any sense of economy. In no case has better streamlining of the body been accompanied by a decrease in engine displacement. Consequently, while great gains in fuel economy are theoretically possible, the American motoring public in the past at least has not been sufficiently interested to warrant manufacturers introducing such economy features if they in any way affect the operator's comfort or convenience. Perhaps if purchasing power is to remain definitely below pre-depression levels, they will be more interested in fuel economy in the future. Who knows?

Hawley Brake for Ford Replacement



Hawley brake for Ford cars in section and elevation

HAWLEY-JONES COMPANY, Corning, N. Y., is manufacturing a Ford replacement brake in which both sides of the lining are used as friction surfaces, the lining being allowed to float freely between the drum and the shoe. Among the advantages claimed for this arrangement are that it assures long life and uniform wear of the lining and that it eliminates brake noise due to high unit pressure. According to the manufacturer, the lining revolves at about half the speed of the drum, and the brake does not grab or chatter regardless of the pressure of application. Replacement is effected by removing the wheel and slipping a new lining into place.

The brake has been applied also to buses, and in that case a water-cooled shoe is used.

BARNES - MADE SPRINGS

Spring Steel from Barnes' own Steel Mill, Engineering and Experimental facilities when needed, Elastic Production Methods — for one or a million parts. Deliveries . . . when promised . . . as promised. Get a Barnes quotation.

THE WALLACE BARNES CO
B R I S T O L , C O N N E C T I C U T

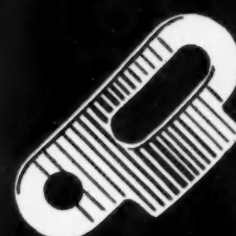
SPRING MAKERS FOR MORE
THAN THREE GENERATIONS



FLAT SPRINGS



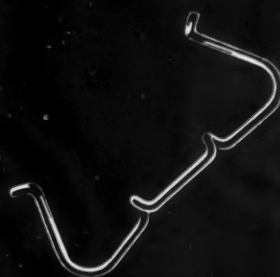
COMPRESSION SPRINGS



SMALL STAMPINGS



EXTENSION SPRINGS



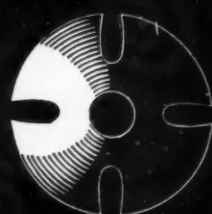
WIRE FORMS



SCREW MACHINE PRODUCTS



TORSION SPRINGS



SPRING WASHERS



MOTOR SPRINGS



COLD ROLLED SPRING STEEL

AUTOMOTIVE INDUSTRIES Through Tests of Reader In

During past years many tests have been made to determine the relative standing with their readers of publications reaching those in automotive manufacturing plants. The results have been the same. AUTOMOTIVE INDUSTRIES leads. A prominent manufacturer has recently made another such test. The results are given below. In this test approximately 850 of the principal engineers, production men, general executives, purchasing agents, service managers, sales managers, and others, in 55 leading automotive manufacturing plants were questioned. Of these 292 replied.

Analysis of Replies Showing Number Receiving Each Publication

Publication	Number Receiving
AUTOMOTIVE INDUSTRIES	238
A Technical Society Journal	186
An Automotive Daily	182
Another Automotive Weekly	167

Preference Analysis on Point Basis

For First Preference—4 points, for Second Preference—3 points, for Third Preference—2 points, for Fourth Preference—1 point. Where 2 or more publications were checked and no preference shown, the points were divided accordingly.

Publication	Points Received
AUTOMOTIVE INDUSTRIES	771
An Automotive Daily	549½
A Technical Society Journal	474
Another Automotive Weekly	454½

**AUTOMOTIVE INDUSTRIES Has
Automotive Publication Among
Automotive Manufacturing**

●

AUTOMOTIVE
A Chilton Publication - Chestnut &

Proves Its LEADERSHIP Interest In Automotive Plants

In another case, a New York advertising agency mailed 1000 questionnaires to the principal engineers, production men, general executives, purchasing agents, service managers, sales managers, and others in 100 leading automotive manufacturing companies. 364 replies were received.

The questionnaire read: "Please check the publication in the following group that you read with most regularity and interest."

Analysis of Replies From Those Voting for One Publication Only

Publication	Preferred by
AUTOMOTIVE INDUSTRIES	92
An Automotive Daily	39
Another Automotive Weekly	20
A Technical Society Journal	20

The vote for AUTOMOTIVE INDUSTRIES exclusively was approximately 2½ times that for the next publication.

The remainder of those replying voted for more than one publication.

151 voted for combinations of publications *including*
AUTOMOTIVE INDUSTRIES

30 voted for combinations of publications *not including*
AUTOMOTIVE INDUSTRIES

And that's a ratio of 5 to 1 in favor of AUTOMOTIVE
INDUSTRIES

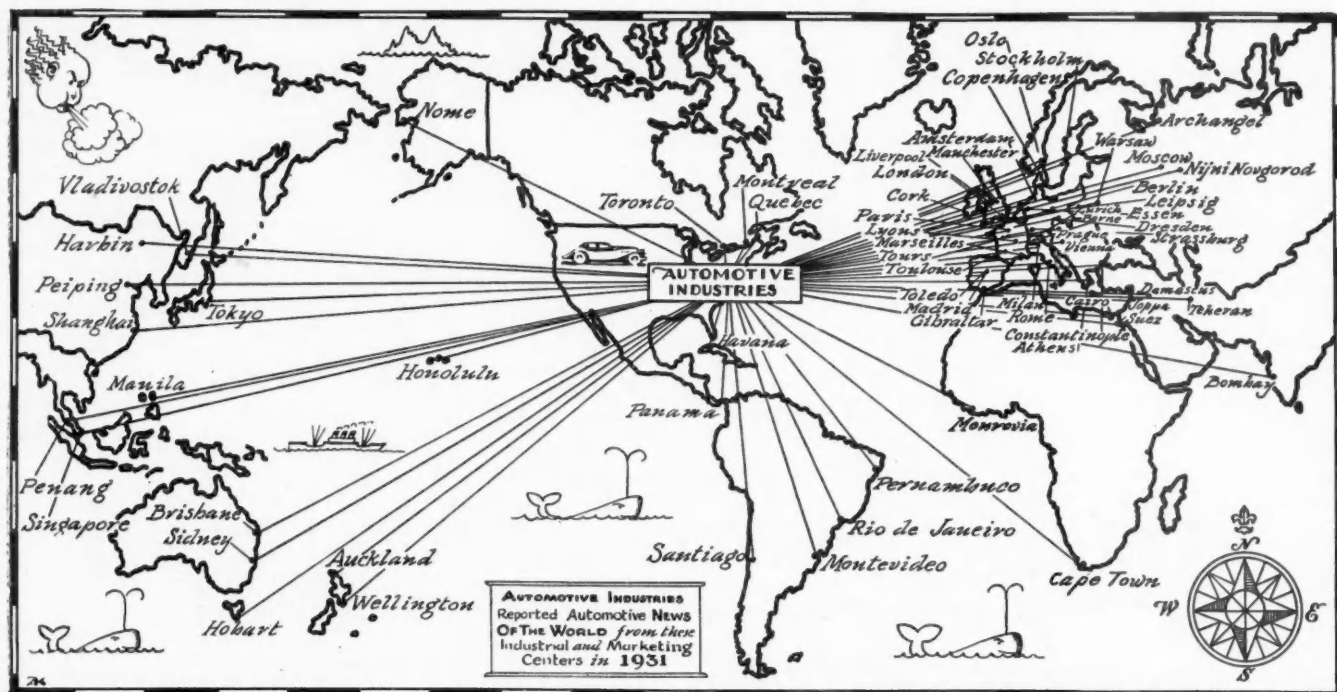
KNOWING the leading publication for your automotive advertising is important today!

The Biggest Circulation of Any Men Directly Connected With In All Its Phases

INDUSTRIES

56th Streets, Philadelphia, Pa.

What about the *other* Detroit's?



News of the automotive world is printed weekly in *Automotive Industries*

Automobiles are made and sold in London, Paris, Singapore; all over the world. Detroit is the greatest of the world's automotive manufacturing centers but it is not the *only* one. Each of the others is important in the territory it serves.

Automotive Industries reports the news from all the world's automotive centers. In the great European centers: London, Paris, Berlin . . . the correspondents of *Automotive Industries* represent the highest type of automotive technical journalist.

The news-gathering organization of *Automotive Industries* is worldwide. It is rooted in a thirty-year old reputation for accuracy. Its prestige is international.

AUTOMOTIVE INDUSTRIES

A Chilton Publication

Chestnut and 56th Streets

PHILADELPHIA

Cable address: Autoland

Correspondents in the principal cities of the United States and Canada.

Registered correspondents in London, Paris, Berlin, Melbourne. Correspondents of affiliated publications in nearly all Spanish or English speaking countries.

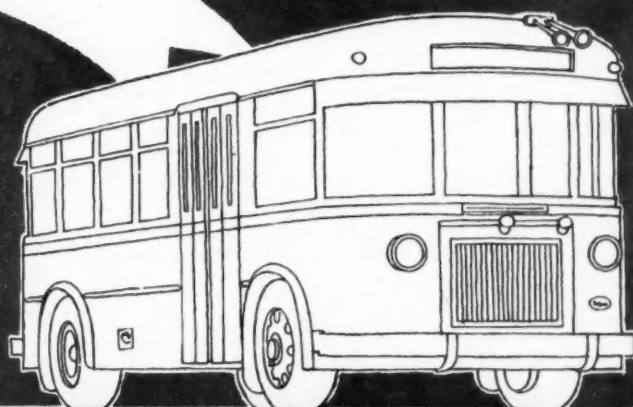
March 25, 1933

Automotive Industries

BENDIX·WESTINGHOUSE

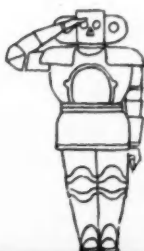
AIR BRAKES

enter a new class of service



STANDARD EQUIPMENT ON THE 20 PASSENGER..MODEL 19 *Twin Coach*

True, Bendix-Westinghouse Control has long been associated exclusively with larger, heavy duty vehicles. Today, however, marks a new step in the history-making progress of this matchless power-to-stop * With its adoption as standard equipment on the model 19, twenty passenger Twin Coach, the industry has seen a new standard of braking comparison established in fleet, light-weight service. Entering this new field, Bendix-



Westinghouse Control shows, to even greater advantage, its instant, positive action, unparalleled flexibility and traditional safety. Nothing unusual about this performance . . . merely a continuance of a dependable service the world has learned to expect from modern, Automotive Air Brakes. And a strengthening point to the accepted fact that only Bendix-Westinghouse Air Brakes are capable of delivering genuine air brake performance.

BENDIX·WESTINGHOUSE
AUTOMOTIVE AIR BRAKE COMPANY
PITTSBURGH, PENNSYLVANIA

AMERICAN SPRING AND MFG. CORP.
SPRINGS—COIL and FLAT
WIRE FORMS
HOLLY, MICHIGAN

DEOXIDINE—
 Prepares Auto Bodies for
 Painting
RODINE—
 Pickle Bath Control
STRIPPLE
 High Speed Enamel Remover

AMERICAN CHEMICAL PAINT CO.
AMBLER, PENNA.

PEROLINE—
 Rust Preventing Oil
KEMICK—
 Manifold Paint
FLOSOL—
 Soldering Flux
PARADOX—
 Rust Proofing Enamel

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ELECTRIC AND FUEL FIRED

BUYERS' GUIDE

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on Page 43

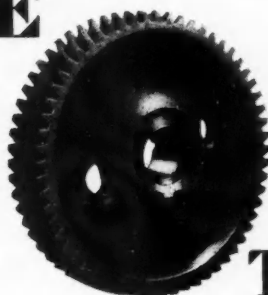
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Acid, Sulphuric New Jersey Zinc Co.	Brakes <i>Air</i> Bendix - Westinghouse Automotive Air Brake Co. Bushings <i>Fibre</i> Continental - Diamond Fibre Co. Cable <i>Ignition, Starting & Light- ing</i> General Electric Co. Camshafts Atlas Drop Forge Co. Castings <i>Malleable Iron</i> Timken Roller Bearing Co. Channels for Glass <i>Felt</i> American Felt Co. Cleaners <i>Metal</i> American Chemical Paint Co. (Rust Pre- ventive) Clutches Borg & Beck Co. Compressors, Air Bendix - Westinghouse Automotive Air Brake Co. Connecting Rods Atlas Drop Forge Co.	Crankshafts Atlas Drop Forge Co. Cups, Lubricating Gits Bros. Mfg. Co. Cutters Davis Keyseater Co. (Keyseating) Fellows Gear Shaper Co. (Gear) Disks, Clutch Borg & Beck Co. Drilling Machines Foote-Burt Co. Enamels American Chemical Paint Co. (Rust Proofing) Bakelite Corp. Felt American Felt Co. Fenders Motors Metal Corp. Fibre Rods, Sheets, Tubes Continental - Diamond Fibre Co. Forgings Atlas Drop Forge Co. Furnaces, Electric (Annealing, Carburizing, Heat Treating, Forging and Welding) Electric Furnace Co. Gaskets <i>Felt</i> American Felt Co.	Gear Cutting Machines Fellows Gear Shaper Co. (Shapers) Gear Material <i>Non-Metallic</i> Bakelite Corp. Continental - Diamond Fibre Co. Gears <i>Timing, Non-Metallic</i> Continental - Diamond Fibre Co. General Elec. Co. Grinding Machines Fellows Gear Shaper Co. Hammers <i>Power</i> Chambersburg Engi- neering Co. Chambersburg National Co. National Machinery Co. Heat Treating Barnes Co., Wallace Barnes - Gibson - Ray- mond, Inc. Gibson, Wm. D., Co. Hoods Motors Metal Corp. Hose, Flexible Metallic (Radiator and Fuel Lines) Titeflex Metal Hose Co. Insulating Material Bakelite Corp. Continental - Diamond Fibre Co. Keyseaters Davis Keyseater Co.	Lamps General Elec. Vapor Lamp Co. Lapping Machines Fellows Gear Shaper Co. Lathes <i>Automatic Chucking</i> Potter & Johnston Ma- chine Co. <i>Turret</i> Potter & Johnston Ma- chine Co. Lighting Equipment, Electric General Elec. Co. (Fac- tory) Lubricators, Chassis Gits Bros. Mfg. Co. Molded or Machined Parts (Phenolic) Bakelite Corp. Continental - Diamond Fibre Co. Motors, Electric Power General Elec. Co. Oil <i>Brake In</i> Acheson Oildag Co. <i>Lubricating</i> Acheson Oildag Co. Pads <i>Felt</i> American Felt Co. Paints <i>Heat Resisting</i> American Chemical Paint Co.
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March 25, 1933

Automotive Industries

TEXTOLITE



TIMING GEARS

A Brief Text on Textolite

TEXTOLITE camshaft gears *permanently maintain* the original relation between camshaft and crankshaft.

This timing device is of the simplest conceivable design and has the smallest possible number of parts.

Since the specific gravity of Textolite gears is very low—about one-half that of aluminum—their use reduces inertia forces, during acceleration or deceleration, to the minimum.

Because Textolite has a high internal, mechanical hysteresis, the use of Textolite gears substantially dampens sound.

As it is forty times as elastic as steel, it tends to absorb and smooth out the vibrations which interact between camshaft and crankshaft.

In a good gear-timing device, there can be no compromising with accuracy; its accuracy is a token of good manufacturing throughout the car.

PLASTICS DEPARTMENT, GENERAL ELECTRIC CO.
West Lynn, Mass.

830-127

GENERAL ELECTRIC

BUYERS' GUIDE—Continued

Pickling Compounds American Chemical Paint Co.	Running Boards <i>Metal</i> Motors Metal Corp.	Stampings or Drawings, Metal Barnes Co., Wallace Barnes - Gibson - Raymond, Inc. Cook Spring Co. Gibson Co., Wm. D. Motor Metal Corp. Raymond Mfg. Co. Worcester Stamped Metal Co.	Spring Barnes Co., Wallace Barnes - Gibson - Raymond, Inc. Gibson Co., Wm. D. Stainless Republic Steel Corp. Strip Republic Steel Corp. Tool Timken Roller Bearing Co.	Turret Machines, Automatic Potter & Johnston Machine Co.
Pipe (Alloy for Bending) Cerro de Pasco Copper Co.	Rust Removers & Preventives American Chemical Paint Co.	Steam Cooling Rushmore Laboratory		Varnishes Bakelite Corp.
Powerplants, Industrial General Elec. Co.	Screw Machine Products Barnes Co., Wallace	Steel <i>Alloy</i> Republic Steel Corp. Timken Roller Bearing Co. <i>Bars</i> Republic Steel Corp. Timken Roller Bearing Co. <i>Billets</i> Timken Roller Bearing Co. <i>Carbon</i> Republic Steel Corp. Timken Roller Bearing Co. <i>Cold Drawn</i> Republic Steel Corp. <i>Electric Furnace</i> Timken Roller Bearing Co.	Supplies <i>Die Makers'</i> Cerro de Pasco Copper Corp. <i>Forging</i> Cerro de Pasco Copper Corp. <i>Heat Treating</i> Cerro de Pasco Copper Corp. Tapping Machines Foote-Burt Co. Thread Generators Fellows Gear Shaper Co. Tubing <i>Flexible Metal</i> Titeflex Metal Hose Co.	Washers <i>Felt</i> American Felt Co.
Presses Chambersburg Engineering Co. Chambersburg National Co. Cleveland Punch & Shear Works Co. National Machinery Co.	Screw Machines Potter & Johnston Machine Co.			Welders, Electric General Electric Co.
Punches Cleveland Punch & Shear Works Co.	Shears Cleveland Punch & Shear Works Co.			Wicks, Felt American Felt Co.
Radiator Shells Motor Metal Corp.	Sheet Metal Machines Cleveland Punch & Shear Works Co.			Wire <i>Flat, Round, Square or Special Shape</i> Barnes Co., Wallace <i>Spring</i> Barnes Co., Wallace Republic Steel Corp.
Radiators Young Radiator Co.	Springs <i>Extension, Compression, Torsion or Flat</i> American Spring & Mfg. Corp. Barnes Co., Wallace Barnes - Gibson - Raymond, Inc. Cook Spring Co. Gibson Co., Wm. D. Raymond Mfg. Co.			Wrenches Gunite Foundries Corp.
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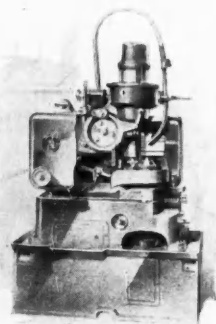
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